Beyond the Visible: Reimagining Legal Evidence Through Causal Realism

How Courts Undervalue Scientific Explanation — and Does the Metaphysics Surrounding Causal Realism Deserve Its Due?

Michael Minutillo

Abstract

This paper examines how courts approach legal evidence through the lens of causation and argues for the adoption of Anjan Chakravartty's framework of causal realism. While legal standards such as Daubert v. Merrell Dow prioritize observable regularities and statistical correlations, they often undervalue explanatory mechanisms rooted in real but unobservable causal processes. Drawing on case studies involving asbestos, climate change, glyphosate, and the opioid crisis, the paper shows how causal realism could better capture the dispositional properties and continuous causal processes central to modern science. Ultimately, the paper advances ideas that surround integrating causal realism into evidentiary standards and how it would potentially allow courts to more fairly and effectively assess complex scientific testimony, especially in cases where waiting for direct observability may undermine justice.

Introduction: Seeing Beyond the Observable

Envision a legal system where the law was able to embrace a much deeper view of causation — one not merely rooted in patterns of observable facts, but in the real, underlying processes that produce them. A system implementing these standards would question expert testimony not solely based on statistical correlation or direct observation, but on its ability to explain and identify the dispositional properties and causal processes that bring about harm. Dispositional properties refer to the inherent powers, tendencies, or capacities of an entity that enable certain effects to occur under the right conditions (things like a chemical's tendency to cause DNA damage, or CO2's capacity to trap heat and alter atmospheric dynamics). I thus pose a question: what if the judiciary system, much like in science, were willing to make inferences upon the existence of real but unobservable forces (e.g., carcinogenic properties, environmental dynamics, molecular mechanisms), based on structured and coherent expert explanations and analysis rather than their immediate observability?

This paper will explore the plausibility surrounding the implementation of this hypothetical, addressing its potential drawbacks and criticisms, while drawing upon the ideas of philosopher of science Dr. Anjan Chakravartty and his explanation of causal realism, a metaphysical approach that looks at causation as rooted in real, though often unobservable, powers.[1] This approach contrasts sharply with the Humean-influenced legal model (which prizes empirical regularity over unseen mechanisms); however, this shift offers a nuanced and more modernized perspective that aligns far better with the genuine functionalities and metaphysics undeniably connected to science — potentially revolutionizing how justice ought to be served in

[1] ANJAN CHAKRAVARTTY, *A Metaphysics for Scientific Realism: Knowing the Unobservable* (Cambridge Univ. Press 2007).

cases surrounding the complexities of causation. In this paper, I will argue that courts should expressly include mechanistic and explanatory scientific reasoning into their causation analysis, approaching evidence of dispositional properties and underlying causal processes as methodologically valid under Federal Rule of Evidence 702, the primary rule governing the admissibility of expert testimony. This shift would not go so far as to abandon the *Daubert* framework but it would instead reinterpret it so that unobservable yet scientifically well-supported mechanics can satisfy evidentiary burdens. I further note that this realist approach should apply especially in areas where harms unfold through complex or long-term processes (toxic torts, climate litigation, pharmaceuticals, public health, etc.) in which Humean norms systematically under-appreciate scientific knowledge.

Causal Realism and the Metaphysics of Explanation

Chakravartty's presentation of causal realism rethinks the idea of causation from the ground up. In *A Metaphysics for Scientific Realism*, he makes the argument that obtaining scientific knowledge is not merely about noticing patterns, but about discovering real properties and structures that lead things to act in certain ways. Things like the viral mechanism of a disease or the toxicity of a chemical exist through "continuous causal processes," even if they are not directly observable by us.[2] A legal system that inherited this approach would insightfully examine expert testimony not only based on what the visible outcomes are, but also on the plausibility and coherence of the mechanisms that the provided evidence and science seek to describe. This system would allow courts to recognize that unseen causes are not completely unreal.

[2] CHAKRAVARTTY, supra note 1, at 89-91.

Chakravartty makes it clear that in taking causation seriously, we must do more than just redescribe regular successions of events. He makes the arguments that realism about science binds us to causal processes rooted in dispositional properties (features including mass, chemical structure, charge) that grant stable tendencies the ability to behave in certain ways across various circumstances.[3] From this perspective, causation does not just entail "A followed by B," but of continued interactions in which those properties are created over time.[4] A process like exposure to toxins, cellular/DNA damage, and eventual development of disease is not just a loosely-tied string of multiple unrelated events; it is a robust sequence that is connected by the causal powers of the involved substances. When fitting this to legal practice, a court that is taking causal processes seriously would not demand an isolated "triggering event" that makes liability suddenly appear. Rather, it would now ask from the expert's account whether a coherent process that connects the defendant's doing, through known dispositions, to the harm of the plaintiff is involved.

The Laws of Humean Legacy

Today, courts utilize an approach to causation that mirrors much of the Humean philosophy: causation should be treated as observable, testable, and usually statistical. When looking at the standards like in *Daubert v. Merrell Dow Pharmaceuticals, Inc.* (1993) ("*Daubert*"), evidence given by experts must be deemed "scientifically valid," meaning it must be based upon testable methods that are widely accepted.[5] Daubert itself involved parents alleging that the anti-nausea drug Bendectin caused birth defects. The trial court did not include their

[3] Id. at 106-08 (developing a process-based view of causation centered on dispositional properties).
[4] Id. at 107-09 (arguing that events are coarse-grained shorthand for underlying continuous causal interactions).
[5] Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993).

expert testimony as it was deemed to be insufficiently "scientific." The Supreme Court reversed the decision, holding that Rule 702 required judges to act as gatekeepers by evaluating the reliability of expert methodology rather than simply deferring to “general acceptance.” The Court then specifically articulated a set of factors including testability, peer review, general acceptance, and error rates that now lay the foundation for how courts assess scientific evidence. Typically, the testimony of an expert is more favorable when it demonstrates significant statistical relationships or visible effects. For reference, in *General Electric Co. v. Joiner* (1997), the claims connecting exposure of chemicals and cancer (A causing B) were deemed to be speculative, and thus were rejected by the courts because they were not directly observable, and in turn, unconvincing.[6] The outcomes of these cases demonstrate the law’s frequent and deep-rooted preference for empirical regularity (consistent observation of patterns or correlations between events), pushing aside metaphysical explanations that may be equally sound.

The empiricist nature of the law is no accident. For a long time, courts have hinged reliability on what can be publicly observed, reproduced, and cross-examined before a jury. This particular preference illustrates exactly what Chakravartty describes as a reluctance to move beyond “shallow” realism, one that tolerates talk of certain unobservables only as long as it stays very close to observation.[7] After *Daubert,* legal doctrine usually treats scientific validity based upon its demonstrability and testable regularities. However, as Chakravartty emphasizes, a scientific realism that is defensible, including its commitment to causal realism, also must account for “concrete structures” and properties that are unobservable and cannot be exhaustively characterized by surface regularities alone.[8] In order to truly uncover why patterns hold, courts

[6] Gen. Elec. Co. v. Joiner, 522 U.S. 136 (1997).
[7] *See* CHAKRAVARTTY, supra note 1, at 89–90 (discussing “shallow” forms of realism tied closely to observation).
[8] Id. at 89–91 (describing realism as a commitment to concrete unobservable structures, properties, and processes).

would need to look beyond what is merely surface-level evidence; if not, they risk treating science as a bookkeeping exercise rather than an explanatory enterprise. These legal shortcomings are challenged by Chakravartty's concept of causal realism, which pleads that the law can, and sometimes must, seriously consider the very real underlying dispositional properties that exemplify harmful outcomes as more than just correlations by coincidence.

Legal Standards of Expert Testimony and Causation

A complete legal analysis requires positioning causal realism within existing evidence doctrine, this most importantly being Federal Rule of Evidence 702. Under Rule 702, an expert may testify if the knowledge they obtain will help the trier of fact, is based on sufficient facts or data, and is the product of reliable principles and methods, reliably applied to the case.[9] Courts will typically view these through the Daubert factors (testability, peer review, error rates, general acceptance), which will most often lean toward directly observable or statistically demonstrable mechanisms.[10] This reinforces the Humean tendency to reward more surface-level regularity over deeper explanatory models.

Causation in tort law also functions through structured burdens of proof (preponderance of evidence in civil cases) and doctrinal categories like general causation (can the agent in question cause this type of harm?) and specific causation (did it cause the plaintiff's harm?).[11] Traditional doctrine frequently mandates plaintiffs to meet these burdens using epidemiological or directly observable evidence. There is now a friction that is created when causal mechanisms

---

[9] Fed. R. Evid. 702.

[10] Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 593–94 (1993) (articulating the reliability factors used to evaluate expert testimony).

[11] See, e.g., Reference Manual on Scientific Evidence 617–18 (3d ed. 2011) (explaining general vs. specific causation standards); In re Nat'l Prescription Opiate Litig., 976 F.3d 664, 697–98 (6th Cir. 2020) (discussing burdens of proof in causation).

unfold across distributed systems, extended time frames, or processes that are unobservable (common in toxic torts, environmental harms, and pharmaceutical litigation).

However, some courts have already pushed beyond this predominantly Humean centered model. In *Milward v. Acuity Specialty Products Group, Inc*., the First Circuit held that a mechanistic weight-of-evidence approach could satisfy Rule 702 even in the case that statistical correlations were incomplete.[12] The court outwardly rejected this idea that expert testimony must rely on a single epidemiological study or directly observable causal sequencing, placing emphasis on reasoning that science often proceeds by integrating mechanistic, toxicological, and inferential evidence. *Milward* justly stands as direct judicial support for a more realist approach to causation in the legal system, one that would be capable of recognizing underlying causal processes even when they cannot be isolated in a simplified A→B pattern. It is important to note that *Milward* postdates *General Electric v. Joiner,* signaling that federal courts have started to soften the more rigid empiricist model Joiner appeared to have endorsed.[13]

This doctrinal development already reflects a judicial willingness to move beyond more strict empiricism, thus opening conceptual space for a causal-realist framework.

Applications of Causal Realism in Legal Decision-Making

The contexts involving climate make the stakes surrounding a shift toward a causal realist approach to legal causation particularly vivid. Recent climate liability suits (ones like youth-led campaigns to challenge the government's lack of action) often fail, not because there is weak scientific evidence behind global warming, but because courts struggle to apply traditional

[12] Milward v. Acuity Specialty Prods. Grp., Inc., 639 F.3d 11, 17–18 (1st Cir. 2011).
[13] Gen. Elec. Co. v. Joiner, 522 U.S. 136 (1997).

doctrinal tests to diluted, long-term causal processes. A Humean-inflected lens tends to ask whether or not a given emission or action/non-action can be paired with a discrete, observable harm. In this case, causal realism would suggest a different framing: greenhouse gases contain dispositional properties that, when applied broadly, consistently manufacture numerous atmospheric and ecological changes.[14] The legal question of relevance now becomes not whether one smokestack directly "caused" a single wildfire, but whether the mechanisms pointed out by climate science show the kind of real, underlying connection that enables the justification of assigned responsibility across time and space. By placing focus on ongoing processes as opposed to isolated events, courts could be able to recognize that contributing to a harmful system can itself count as a legally meaningful form of causation. Under a preponderance standard—requiring a showing that the claims are more likely true than not—courts often hesitate when causal chains span over decades, even though scientific mechanisms are still well understood.

Let us also consider the following case, *Hardeman v. Monsanto Co.* (2021), in which the plaintiff alleged that the use of the glyphosate-based herbicide, Roundup, caused non-Hodgkin's lymphoma.[15] The defense relied chiefly on the lack of direct epidemiological consensus, while the plaintiff's case centered around evidence that involved DNA damage potentials that were caused by exposure to the chemical compound. This evidentiary posture reflects the traditional preference for epidemiology in establishing both general and specific causation, a requirement grounded in existing toxic tort doctrine. Utilizing the foundation of causal realism, in this case, having the mere presence of a biologically plausible mechanism (consistent with known

[14] *See generally* CHAKRAVARTTY, supra note 1, at 94-96 (arguing that objective causal necessity distinguishes genuine causal regularities from merely accidental patterns).
[15] Monsanto Co. v. Hardeman, 141 S. Ct. 289 (2021).

biochemical interactions) could be sufficient evidence in determining legal causation, even with the absence of statistical correlation. Although the implementation of the causal realist framework would have changed little about the case's outcome (considering the courts ruled in favor of the plaintiff for an initial amount of $80 million — later reduced to ~$25 million), it remains important to consider how the strategies of the plaintiff and defense would have changed had the court embraced this new approach. It also begs to question just how much easier proving causation in this case would have been, and if the initial amount awarded to the plaintiff would have been reduced, having no doubt of the company's legal liability.

Mass tort litigation (legal actions where many individuals file lawsuits against one or more defendants for harm caused by the same product, action, or event), presents another realm of law in which a causal-realist framework could be especially productive in legal argumentation and analysis. In *In re National Prescription Opiate Litigation* (2020), hundreds of state, county, and municipal governments—including cities, counties, and tribal entities across the United States— sued pharmaceutical companies for their role in the opioid crisis.[16] While patterns of prescription data and overdose rates were visible, many of the arguments were based on establishing a link of causation through internal marketing strategies, prescriber behavior modification, and biochemical addiction pathways. A hypothetical court system wielding the weapon of causal realist interpretations would recognize that the opioid crisis emerged not from a single cause, but from a web of interacting factors that together formed a continuous causal process. Rather than dismissing this angle as purely speculative, causal realism would look at the dispositional properties of opioids (their addictive nature) and the systemic behaviors of manufacturers and distributors as jointly explanatory. The usage of this framework would allow,

[16] In re Nat'l Prescription Opiate Litig., 976 F.3d 664 (6th Cir. 2020).

in this case in particular, courts to acknowledge how indirect, interacting, and long-term causes can still add up to be legal causation — even without a singularly identified triggering event.

In the domain of forensic science, we can observe some similar tensions beginning to appear. Since *Daubert*, judges have often equated "scientific validity" with methods that present numerical error rates or appear heavily quantified, even when their underlying mechanisms are poorly understood. Numerous techniques, including bite-mark comparison, various types of pattern matching, and overstated ballistics testimony, have often been criticized due to the idea that they rely on surface-level regularities without a well-grounded documentation of why these occurrences should track truth.[17] The evidentiary priority would be inverted from the perspective of a causal realist, meaning that a method would not be deemed reliable because it yields repeatable matches; it is instead reliable if there is a well-supported causal story that links the physical trace to the conclusion the expert has made (i.e., the chemistry of gunshot residue or the molecular basis of DNA profiling). When courts give benefit to regularity instead of explanatory depth, they risk aligning with what Chakravartty calls "accidental series of happenings" as if they stood for genuine necessity.[18] Highlighting dispositional properties and mechanisms would push judges to prefer forensic methods that also have explanations as solid as their evidence appears in the courtroom.

In this hypothetical institution, expert testimony would not simply fail or be dismissed because of an inability to point to the "smoking gun." Rather, causal realism would now ask: Does the expert explain how the cause plausibly produces the effect through known causal

---

[17] *See,* e.g., United States v. Glynn, 578 F. Supp. 2d 567, 574–75 (S.D.N.Y. 2008) (expressing concern about overstatements of certainty in ballistics testimony and limiting expert conclusions).

[18] CHAKRAVARTTY, supra note 1, at 94 (nothing that causal necessity helps distinguish robust causal regularities from merely accidental ones).

processes? Is the underlying mechanism coherent with accepted scientific theories? This would favor mechanism-based reasoning instead of purely statistical or observational methods. Utilizing this consideration of metaphysics would still allow courts to maintain high standards for admissibility; however, it would no longer hold back science for being theory-driven, as it often is, especially in cases that involve complex systems (e.g., environmental damage, pharmaceuticals, public health).[19]

It is imperative to now consider the following: in practice, what would this change look like? First and foremost, the judge in a given case would be encouraged to consider whether a scientific claim involves well-supported causal properties, even when the relationship ($A \rightarrow B$) is delayed or probabilistic. *Borel v. Fibreboard Paper Products Corp* (1973) is an example of this practice. In this related asbestos lawsuit, causal realism would underscore the known dispositional property of asbestos to cause mesothelioma over time, regardless of whether just one moment of exposure can be directly connected to the illness.[20] In a similar vein, considering the landmark environmental regulatory case *Massachusetts v. EPA* (2007)—a case in which the Supreme Court held that greenhouse gases qualify as 'air pollutants' under the Clean Air Act and required the EPA to regulate them—causal realism would support the usage of climate models and feedback mechanisms and coherent explanations of harm, thus perceiving greenhouse gases not only as correlated with global warming, but as possessing real properties that drive long-term planetary effects.[21] In short, causal realism would have backed the legitimacy of acting before catastrophic effects become directly observable — grounding policy in explanatory depth rather than waiting for more empirical regularity.

[19] CHAKRAVARTTY, supra note 1, at 92-95
[20] Borel v. Fibreboard Paper Prods. Corp., 493 F.2d 1076 (5th Cir. 1973).
[21] Massachusetts v. Envtl. Prot. Agency, 549 U.S. 497 (2007).

Philosophical Resistance and Judicial Reluctance

I must now address the lingering question: Why hasn't this metaphysical shift happened? In part, it is because courts tend to avoid anything that seems abstract, speculative, or untestable (a lot of which goes hand in hand with causal realism). The idea that the legal system values clarity, objectivity, and visible proof would be an understatement. Metaphysics, considering its talk of dispositions and unobservable structures, may seem as if it is a mismatch when it comes to the evidence-based rigors expected of law today. This judicial emphasis on concrete, observable evidence is deeply rooted in evidence doctrine. The Federal Rules of Evidence repeatedly privilege perceptible, empirically grounded proof; for example, Rule 602 requires witnesses to testify only from "personal knowledge," and Rule 701 places limits on lay opinions to those derived from direct perception. Also, evidence theorists such as Legal philosopher Jeremy Bentham emphasised that fact-finding must rest on forms of proof that are accessible to the public and intelligible to normative reasoning, a theme in which historically favored observable facts over opaque or highly theoretical mechanisms. Evidence scholar John Henry Wigmore, similarly, framed relevance in terms of inferences that a lay factfinder can rationally evaluate, which (although not excluding inferential and scientific evidence) specifically prioritizes evidence whose probative force can be traced from a clear and comprehensible chain of reasoning. This framework of background assumptions assists in explaining why courts instinctively distrust testimony grounded in mechanisms that are unobservable, even in cases when such mechanisms are central to scientific explanation.[22] Judges are trained to believe in data that is observable and are highly cautious about adopting foundations that may appear to

[22] See FED. R. EVID. 602; FED. R. EVID. 701; 1 JEREMY BENTHAM, *RATIONALE OF JUDICIAL EVIDENCE* 4–6 (1827); 1 JOHN H. WIGMORE, *EVIDENCE IN TRIALS AT COMMON LAW* § 25 (Tillers rev. 1983).

weaken the standards of proof. Even more so, legal precedent and education have embedded deeply empiricist assumptions into how legal professionals think about causation.[23]

The present judicial discomfort associated with causal realism closely resembles the philosophical anxieties Chakravartty attributes to Hume and Kant. Humean skeptics tend to worry that we never see connections deemed necessary, only constant conjunctions, and thus treat any talk of causal necessity as imagined by the mind. By contrast, Kantian skeptics place necessity in concepts of our own as opposed to in the world itself and see it as a key part of how we organize experience, not how reality actually is.[24] Without using this language directly, many judges take a mixed approach. They tend to treat causal terms as either a convenient way to identify patterns or as a tool for framing legal arguments, but not as something that points to real forces in the world. From this particular perspective, it seems as if causal realism becomes an unnecessary layer within philosophy. However, as Chakravartty claims,if science depends on reasoning about structures and processes that are unobservable already, then opting not to apply that very same realist logic to causation leaves the law constructed and set on "hallowed-out foundations" that realism tries to address.[25]

Challenging this stance demands a look into different fields like climate science, genetics, and public health where expert testimony often relies on explanations that cannot be directly observed but are scientifically concrete. For instance, climate models simulate complex feedback loops involving greenhouse gases, atmospheric shifts, and ocean temperatures. These simulations are not mere guesses; they are constructed on well-understood physical phenomena and

---

[23] *See* generally Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579 (1993) (illustrating judicial preference for empirical, testable evidence).
[24] *See* CHAKRAVARTTY, supra note 1, 93-95 (contrasting Humean and Kantian rejections of causal realism).
[25] *See* CHAKRAVARTTY, supra note 1, at 90-91(describing the need for metaphysical foundations that are not merely promissory notes)

properties. Yet under a strict Humean view, their indirectness may render them too speculative or hypothetical to be used significantly. By continuing to reject evidence of this sort, the courts may potentially risk the exclusion of robust information that science is often the best at producing.[26]

I argue Chakravartty makes a convincing point — capturing this tension and resolving it without completely sacrificing traditional standards. His model of thinking claims that we do not need to see a cause to know it exists; we only need strong, coherent explanations tied to real properties and processes. In legal practice, this would value a testimony that effectively presents a plausible narrative of how something causes harm, even if the narrative involves complex mechanisms. Courts would continue to be very wary of false claims, but they would no longer be immediately skeptical if a causal chain isn't immediately visible. In short, causal realism would force courts to evaluate the quality and coherence of a given explanation, not just data quantity.[27]

Critics of this viewpoint might argue that accepting causal realism may also open doors to subjectivity or speculative theories. I believe this misinterprets the stance. Causal realism does not do away with evidence; it contextualizes it. Nor would a causal-realist framework create boundless liability for all remote or indirect consequences of a given action. Courts would continue to rely on limiting principles (foreseeability, material contribution, the strength of underlying mechanism) to ensure that only scientifically grounded and legally meaningful causal links justify responsibility. It does not go out of its way to ask courts to believe in unicorns or ghosts, but it does ask them to accept that scientific understanding goes beyond what can be seen. For example, dispositions like carcinogenicity of asbestos or warming dangers of CO2 are not fantasies; they are well-explained, testable aspects of the world. Courts already listen to scientific

---

[26] *See* generally Massachusetts v. Envtl. Prot. Agency, 549 U.S. 497 (2007) (recognizing the scientific validity of greenhouse gas modeling).
[27] CHAKRAVARTTY, supra note 1, at 93-96

testimony about phenomena like DNA evidence or toxicology — both of which rely on unobservable processes. Causal realism just puts into words the philosophical commitments that make this possible.[28]

Implementing this ideological foundation would not mean rewriting the entire legal system's rules for evidence. It would more so involve changing how they are interpreted, offering more epistemic ground toward scientific explanations, even when involving invisible causal processes. In acknowledging that science aims not only to predict but to explain, court systems could better assess expert testimony and avoid dismissing valid claims due to metaphysical bias.[29] Because Rule 702 already allows judges discretion to admit methodologically reliable but non-statistical scientific reasoning, embracing causal realism would not require doctrinal upheaval, only a mere reinterpretation more consistent with existing precedents such as *Milward*.

Thinking in terms of dispositional properties and causal processes would also change where to assign responsibility in complex systems. Opioid addiction, pollution, climate change, and other modern harms do not just occur based on one clear act but from numerous combined effects of mechanisms spread across space and time. In this case, a strictly Humean view would not succeed as it is designed for simple, linear causal relations. On the other hand, causal realism is built precisely to handle these modern multi-level problems, as it asks which properties and practices together sustain a harmful process, and what it is that might stop it. A foundational claim from Chakravartty is that scientific realism looks to uncover why patterns even exist in the first place[30] Applying this same thinking to law would support contributions to dangerous

---

[28] See generally Borel v. Fibreboard Paper Prods. Corp., 493 F.2d 1076 (5th Cir. 1973) (acknowledging asbestos carcinogenicity).
[29] CHAKRAVARTTY, supra note 1, at 100-03
[30] *See* CHAKRAVARTTY, supra note 1, at 93-96 (arguing that mere regularities are insufficient for realism without explanatory accounts of why they obtain).

mechanisms as legally meaningful, even in cases when no single act alone causes the harm at hand. It is in this way that causal realism does not weaken the standards of proof, but instead shifts them toward the type of explanatory reasonings that already spearhead legitimate scientific discovery.

Toward a More Explanatory Legal Framework

It is difficult to make the argument that court systems should just completely rethink the way they view evidence. Indeed, *Daubert* already permits courts to consider mechanistic and explanatory reasoning when assessing reliability; the obstacle is now not doctrinal limitation but judicial underuse of the flexibility Rule 702 framework allows for. However, it is fair to claim that causal realism does have a legitimate place in the courtroom, especially on the witness stand. Courts do not need to become philosophical institutions, but they could use some improvement when it comes to recognizing that science routinely works with processes, powers, and dispositions that are not observable in a Humean sense. Embracing causal realism means understanding causation not as a visual sequence of events, but as a string of very real, structured tendencies that give rise to effects.[31] Chakravartty's account of dispositional causation and continuous processes provides a framework that both honors scientific practice and supports legal fairness.[32] When complex legal cases involve things like public health, environmental risk, or slow-developing harms, waiting for clear, "perfect" visible evidence may only come at a time too late to serve justice adequately. A more causally realist approach would not need courts to abandon their existing evidentiary commitments; rather, it would encourage them to make a fuller use of the doctrinal tools already at their disposal to evaluate explanatory,

---

[31] *See generally Daubert v. Merrell Dow Pharms., Inc.*, 509 U.S. 579 (1993) (establishing standards for the admissibility of expert scientific testimony).
[32] CHAKRAVARTTY, supra note 1, at 106-08

mechanism-based scientific testimony. In this sense, causal realism is not a radical abandonment from current practice but a principled refinement of it. It presents a framework that could gradually become a more explicit and more reliable norm within legal reasoning.

Table of Authorities