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Physics in Perspective

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Editorial

Experiment and Discovery

In December 1942, Enrico Fermi oversaw the first controlled, self-sustaining nuclear chain reaction. It was brought forth in Chicago Pile 1, an experimental nuclear reactor at the University of Chicago. Overshadowed by the grim realities of wartime, the event was solemn, but the physicists and technicians who created it immediately recognized the occasion as momentous, and those assembled on the repurposed squash court that held the pile commemorated the occasion by signing a fiasco of Chianti. This story has been retold so often that it is now legend. In part, this is because it encapsulates so many of our presumptions about scientific discovery, which we often imagine can be localized to an instant and pinned to a finite set of discoverers, with both the discovery itself and its significance clear.

But Fermi was no stranger to discoveries—and near misses—and they did not always fit that mold. As Francesco Guerra, Matteo Leone, and Nadia Robotti note in their account of his earlier discovery of neutron-induced radioactivity in March 1933, Fermi appears to have remarked little when recording in his notebook the smoking-gun evidence that neutron bombardment had induced radioactivity in aluminum. The relevant page simply indicates that the data should be accounted for in the final paper—no fanfare, and, so far as we know, no Chianti, but relentless observation of protocol.

Dorel Bucurescu's contribution to this issue also discusses the discovery of artificial radioactivity, addressing still earlier work on alpha-particle-induced radioactivity through the story of the lesser-known Romanian physicist Stefania Mărăcineanu. Her contentious claim to have contributed to the discovery of this phenomenon, normally attributed to Frédéric Joliot and Irène Joliot-Curie in 1934, stemmed from the experiments she conducted for her PhD thesis, which Marie Curie supervised. But here also, Mărăcineanu could point only to an inkling, not to a definitive moment, which she expressed obliquely in her dissertation in 1924 and pursued further in subsequent papers. Her claim ultimately hinged on the procedures she used to *interpret* her meticulously collected data, and Bucurescu's reconstruction of those procedures makes evident how central they are to solidifying discovery claims. Discovery, that is, often resides not in the conduct of an experiment, but in its subjugation to rigorous and often retrospective analysis. And

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it stands or falls not on this analysis alone, but also on the judgment of the wider scientific community.

Historians of science will find this unsurprising, having long sought to complicate the notion of discovery. As early as 1959, Thomas Kuhn questioned the notion of the discovery of the conservation of energy, often understood to have occurred more or less simultaneously in several different locations, showing how the concept was instead gradually cobbled together from subtly distinct antecedent concepts before being smoothed over and repackaged as the principle we now recognize. He later made similar points, still more famously, in *The Structure of Scientific Revolutions*, arguing that while correct, “the sentence ‘Oxygen was discovered,’ misleads,” because it suggests discovering something is a single simple act we can assimilate to our usual idea of vision.

Discovery, then, is more often than not an extended process. Unsurprising though this insight is, these papers illuminate more about the mechanics of that process. Iconic moments of discovery come from meticulous preparatory work, exacting laboratory practice, scrupulous data collection, and rigorous data analysis. The absence of an iconic moment does nothing to diminish the significance of a discovery. On the other hand, poor preparation, sloppiness in the lab, and slovenly data handling can easily conspire to place that discovery out of reach. It is through their close attention to these basic procedural virtues that the two papers in this issue allow us insight into the nature of discovery.

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