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Self-organization of a turbulence-driven ionization instability in hollow cathodes[1] MARCEL GEORGIN, BENJAMIN JORNS, ALEC GALLIMORE, University of Michigan — The self-organization of a plasma into a coherent state is a common phenomenon in nature and plasma technology and in many cases is poorly understood. In the area of low-temperature plasma devices, this is an active area of research as these self-organized states can sometimes be favorable or detrimental for their operation. For example, the hollow cathode is a widely used plasma device that, under some operating conditions, appears to exhibit an oscillatory form of self-organization, the so-called "plume mode" instability. This instability is commonly found in cathodes designed for plasma propulsion devices and occurs at low flow-rate. Historically thought to be ionization wave, this structure is characterized by large-scale, low-frequency oscillations in potential and density. Classical descriptions of this instability do not predict its onset; however, cathode plasmas are notably dominated by the non-classical effects of small-scale electrostatic turbulence. Recent numerical and experimental work has correlated these density oscillations with fluctuations in the turbulence. In this work, we examine the variations in turbulence and their correlation with the ionization rate. To interpret our result, we develop a zero-dimensional model for this turbulence-driven instability.

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