1171-81-9 **Kay L. Kirkpatrick*** (kkirkpat@illinois.edu), 1409 W. Green St, Department of Mathematics, UIUC, Urbana, IL 61801. *Dark Matter may be a Bose-Einstein condensate of axions.*

Dark matter, which has no color but rather is transparent, makes up probably a quarter of the energy-matter density of our universe. Examples such as gravitational lensing and the cosmic microwave background fluctuations suggest that dark matter is common and cannot be explained away by just modifying gravity. One model for dark matter is the hypothetical quantum particle that solves the strong Charge+Parity problem in quantum chromodynamics: the axion.

Clusters of axions are thought to have formed in the early universe, with cores that condense into an ultra-cold Bose-Einstein condensate (BEC) with macroscopic quantum properties. For axion clusters about the size of a star, the mathematical description is a pair of equations: the non-linear Schrödinger (NLS) equation for self-interactions, and a second equation, called Poisson or Newton, for interactions through gravity. In work with Anthony Mirasola and Chanda Prescod-Weinstein, we use an approach based on the Wigner distribution to study the NLS-Poisson system and calculate that the condensation of axions into a BEC is driven by gravity and should happen within the lifetime of the universe. (Received July 20, 2021)