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Supermassive black hole formation in the initial collapse of axion dark matter

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How the supermassive black holes form has been an enduring puzzle. Recent discoveries of active galactic nuclei near cosmic dawn by James Webb Space Telescope suggests that SMBHs may have formed as early as $z \approx 10$. We propose a mechanism that SMBHs form naturally near the cosmic dawn if the dark matter is axion or ALPs. Axion dark matter thermalizes by gravitational self-interactions and forms a Bose-Einstein condensate. We show that the rethermalization of the axion fluid during the initial collapse of large scale overdensities near cosmic dawn transports angular momentum outward sufficiently fast that black holes form with masses ranging from approximately 10^5 to $10^{10} M_{\odot}$.

Mini Symposia (Invited Talks Only)

Plenary (Invited talks only)

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