## **XV Black Holes Workshop**



Contribution ID: 114

Type: not specified

## Z. Zhong: Piercing of a boson star by a black hole

Monday 19 December 2022 16:45 (15 minutes)

New light fundamental fields are natural candidates for all or a fraction of dark matter. Self-gravitating structures of such fields might be common objects in the universe, and could comprise even galactic halos. These structures would interact gravitationally with black holes, a process of the utmost importance since it dictates their lifetime, the black hole motion, and possible gravitational radiation emission. We study the dynamics of a black hole piercing through a much larger fully relativistic boson star, made of a complex minimally coupled massive scalar without self-interactions. As the black hole pierces through the bosonic structure, it is slowed down by accretion and dynamical friction, giving rise to gravitational-wave emission. Since we are interested in studying the interaction with large and heavy scalar structures, we consider mass ratios up to q  $\sim$  10 and length ratios L  $\sim$  62. Somewhat surprisingly, for all our simulations, the black hole accretes more than 95% of the boson star material, even if an initially small black hole collides with large velocity. This is a consequence of an extreme "tidal capture" process, which binds the black hole and the boson star together, for these mass ratios. We find evidence of a "gravitational atom" left behind as a product of the process.

Session Classification: Session 4 A