Contribution ID: **78** Type: **Poster**

Constraints on Dark Matter from the Eccentric Supermassive Black Hole Binary OJ 287

Monday 8 August 2022 14:45 (3 minutes)

A dark matter overdensity around a black hole may significantly alter the dynamics of the black hole's merger with another compact object. The strong gravitational potential of a black hole is theorised to lead to a significant increase in the concentration of dark matter in the central region with the creation of a "spike"in the dark matter density. We consider the case of OJ 287, which is a binary system containing a ~ 18-billion solar mass primary black hole with a ~ 150-million solar mass secondary black hole in an eccentric orbit, which triggers electromagnetic emissions twice in every ~ 12 year period when it traverses the accretion disk of the primary. The accurate timing of those outbursts opens up the possibility of using this system to set constraints on dark matter distributions containing OJ 287 (as well as testing general relativity in a hitherto unexplored strong field regime) in the standard cold dark matter cosmogony. The times of the emissions are consistent with the predictions of general relativity calculated to the 4.5th post-Newtonian order. The orbit of the secondary black hole samples the gravitational field at distances between O(10) and O(50) Schwarzschild radii around the primary, and hence is sensitive to the possible presence of a dark matter spike around it. We find that the agreement of general-relativistic calculations with the measured timings of emissions from OJ 287 constrains the mass of such a spike to 3% of the primary mass.

Primary author: ALACHKAR, Ahmad (King's College London)

Co-authors: Mr ELLIS, John (KCL); Mr FAIRBAIRN, Malcolm (KCL)

Presenter: ALACHKAR, Ahmad (King's College London)

Session Classification: Poster Lightning Talks