



ID de Contribution: 75

Type: **Talk**

The observational signatures of high-redshift dark stars

jeudi 29 juillet 2010 13:40 (20 minutes)

The annihilation of dark matter particles in the centers of minihalos may lead to the formation of so-called dark stars, which are cooler, larger, more massive and potentially more long-lived than conventional population III stars. Here, we investigate the prospects of detecting high-redshift dark stars with upcoming James Webb Space Telescope (JWST). We find that individual dark stars with masses below 1000 Msolar are intrinsically too faint for JWST. However, by exploiting foreground galaxy clusters as gravitational telescopes, certain varieties of dark stars should be within range at $z \sim 10-15$. Since the JWST colours of these objects are very different from those of mundane interlopers in front of, within or behind the lensing clusters, such dark stars should be readily identifiable in JWST imaging surveys. We also argue that, if the life times of dark stars are sufficiently long, many such objects may congregate inside the first galaxies. This could give rise to peculiar features in the integrated spectra of high-redshift galaxies.

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Classification de Session: Parallel Session : Structure Formation & N-body simulations 3