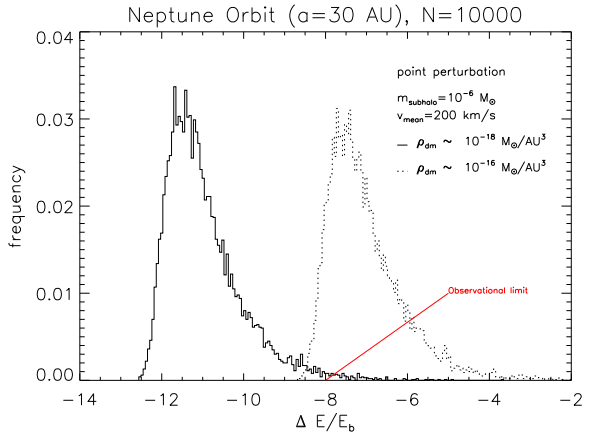

Fig. 1. Energy perturbation due to encounters with subhalos on to the Neptune's orbit for the standard value of local DM density(solid)(Green 2010) and for two orders of magnitude higher(dashed).

forces, and we model them as *streams* of cylindrical symmetry (González-Morales 2011, in prep.). As an illustration we present the case of Neptune's orbit. In Figure (1) we show a Montercalo realization over the perturber-planet impact parameter and relative velocity distributions, assuming the spherical mass approximation, for two different values of the local DM density. Our halo and subhalos parameters are motivated by larger scale N-body simulations that assumes a neutralino power spectrum. The histogram shows the fraction of possible Solar System-substructure encounter histories corresponding an energy injection $\Delta E/E$ over 4 Gyr, approximately the Solar System age. It can be notice that the most important parameter is the amount of DM in the local neighborhood, an uncertainty quantity. This study can be seen as an upper limit for the local DM density if one assumes that neutralinos conform the DM. On the other hand, if local DM density were determined with high accuracy and its value changes significantly from the actual value, then our method would be enough to put a strong constraint on the cut-off of the mass power spectrum, with Solar System information only.

3. CONCLUSIONS AND FUTURE WORK

Although we have only presented the case for Neptune's orbit constraints on dynamical perturbation triggered by dark matter substructure, the same can be applied to Earth-Moon's orbit, were accuracy of orbital elements is even higher. As we mentioned this can be applied also to study the existence of wide stellar binaries in dSphs, which according to some authors should be in disagreement with the DM hypothesis (Hernandez & Lee 2008; Peñarrubia et al. 2010). We are applying the formalism expecting to show either of (1) catastrophic encounters are sufficient enough and disrupt the wide binaries (Peñarrubia et al. 2010) (2) dominant encounters are diffusive but they are sufficient enough to disrupt the binaries or (3) the effect of the dynamical friction due to DM that is not bound in substructure (Hernandez & Lee 2008) in conjunction with the diffusive encounters allows the existence of the wide binaries. The first two scenarios implies that the existence of wide binaries are not consistent with the existence of DM substructure as the cold DM predicts, and warm DM could be a better option, or any other candidate with a power spectrum cut-off at sub-galactic scales. Independent additional constraint to the DM power spectrum could be obtained from the high redshift 21-cm power spectrum, fluctuations in gravitational lensing images and searches of low mass galaxies in the nearby Universe. We are currently making predictions for some of those future experiments (González-Morales 2011, in prep.).

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