reader for details. The mass of baryonic matter in M4 is estimated to be $M_b \sim 10^5 M_\odot$ and the core radius of $0.83'$ in arcminutes implies $r_c = 0.531$ pc when combined with a distance to the cluster of 2.2 kpc. The tidal radius is estimated using a concentration parameter of $\log(r_t/r_c) = 1.59$ giving $r_t = 20.66$ pc. These parameters set the baryon density distribution, which we model with a King profile.

Using cosmological data and taking mass loss during stellar evolution into account, the amount of DM in the original M4 subhalo is estimated to be $M_{DM} \sim 10^7 M_\odot$. For details of this estimation see [2]. The virial radius, which sets the initial DM distribution is estimated using the fitted form of the spherical collapse overdensity [30];

$$\Delta = \frac{18\pi^2 + 82(\Omega_m(z) - 1) - 39(\Omega_m(z) - 1)^2}{\Omega_m(z)} \tag{1}$$

where the matter density is given by [31]:

$$\Omega_m(z) = \left[1 + \frac{1 - \Omega_m}{\Omega_m(1+z)^3}\right]^{-1} \tag{2}$$

We take $\Omega_m(0) = 0.273$ giving $\Delta = 357$. The concentration of low mass halos is given in [31] as;

$$c(z) = \frac{27}{1+z}\left(\frac{M_{DM}}{10^9 M_\odot}\right)^{-0.08} \tag{3}$$

and combining this expression with those for the virial radius, scale radius and central density from [2] the original DM subhalos are completely determined by the parameters:

z	R_{vir} [pc]	a [pc]	ρ_c [$M_\odot$ pc^{-3}]
0	3597	92	0.37

We model the original DM halo with an NFW profile [32]. As discussed in [2] the core density is a very weak function of the total mass of the subhalo, changing only by a factor 3 for halo masses between $10^6 M_\odot$ and $10^8 M_\odot$.

It remains to consider the effects of the baryonic core on the DM distribution. Although the DM density may be enhanced in the core due to the presence of the baryonic core [33–35] the heating of DM particles due to interactions with stars may tend to wipe out this enhancement. Therefore by estimating the timescale over which this process occurs with Eqn. 3a. of [36] we can find the radius at which this timescale is equal to the age of the universe. We find that this radius lies at $r_{heat} = 1.4$ pc and, as this is smaller than the radius where the WDs are observed, we expect heating effects to be small here. The possible important effect is therefore the contraction of the DM core due to conservation of angular momentum when the gas in the original halo which eventually forms the globular cluster loses energy and falls into the core. We use the algorithm of Gnedin [34] to perform this baryonic contraction. Finally as mentioned earlier, to take account of the likely tidal stripping of the stars and DM halo we truncate the density distribution at the tidal radius.

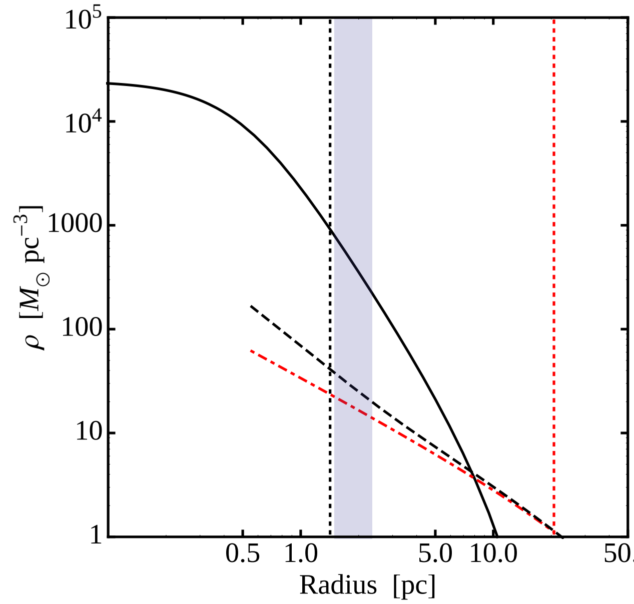

FIG. 1: Densities of stars (solid line) and the DM halo with and without baryonic contraction effects in dashed black and dot-dashed red respectively. The region from which the observed WD data is taken is indicated in shaded blue. The vertical dotted lines denote the radius at which heating effects start to become important (dotted black) and the tidal radius (dotted red).

The estimated DM and star densities for the halos are plotted in Fig. 1. One can see that this estimate for the DM density is much smaller than the baryonic density, and in fact for the contracted (uncontracted) halo DM makes up less than 43% (41%) of the total mass of the cluster, consistent with the observed lack of DM in globular clusters. Further, the total estimated DM content is $7.7 \times 10^4 M_\odot$, less than 1% of the original $10^7 M_\odot$ halo.

We assume a DM density at the largest radius within which the WD data is observed, $r_{max} = 2.3$ pc, giving $\rho_{DM} = 21$ M$_\odot$ pc^{-3} = 798 GeV cm^{-3} for the contracted halo [55].

IV. CAPTURE OF IDM IN WHITE DWARVES

The capture of DM by scattering in stars or planets has been studied for some time, see e.g. [2, 37–44], and recently the capture of iDM in the Sun has been studied [8–10]. It is this work which we extend to include capture in WDs and we follow the formalism first set out in [8], which was subsequently extended to include spin-dependent scattering as well as spin-independent scattering in [10].

Recently spin-dependent inelastic scattering has been suggested as a viable alternative to the standard spin-independent iDM scenario [45], where it is shown that