




Environmental Dependence of the Dynamical Properties of Light-cone Simulation DM Halos.

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Chira, M., Plionis, M. & Agarwal, S., 2019 (in prep.)

Our Motivation

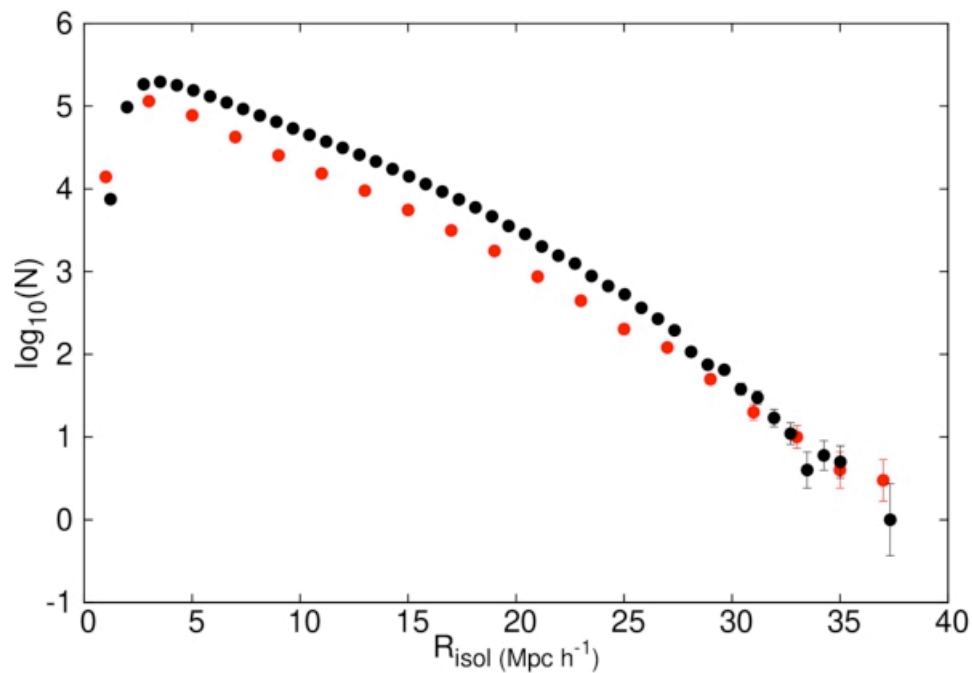
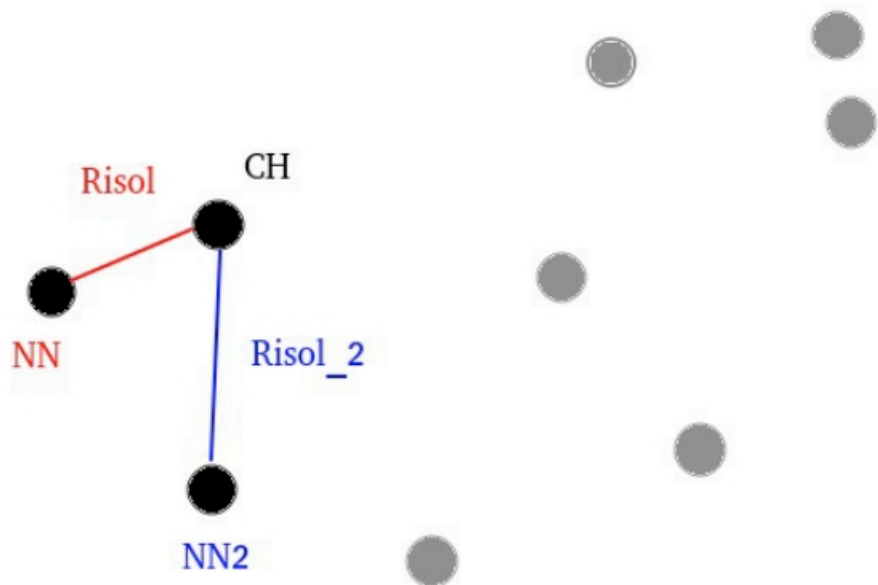
- Importance of understanding the effect of the environment on the DM halo properties.
 - Controversial results of different relevant studies in the literature.
 - Robust conclusions on the environmental dependencies of halo properties are necessary for the comparative analysis of different cosmological models via simulations.
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Our Data

Light-cone data generated on flight during the realization of a subset of N-body simulations from the "Dark Energy Universe Simulation" (DEUS) project.

- 2592 Mpc h^{-1} boxlength.
 - 2048^3 particles
 - Λ CDM: $\Omega_m = 0.26$, $h = 0.72$
 - Full-sky $0 < z < 0.65$
 - Resolution: $m_p = 1.5 * 10^{11} M_\odot / h$
- 3110107 halos of $M(10^{14} M_\odot) \in (0.146, 27.795)$

Our definition of environment



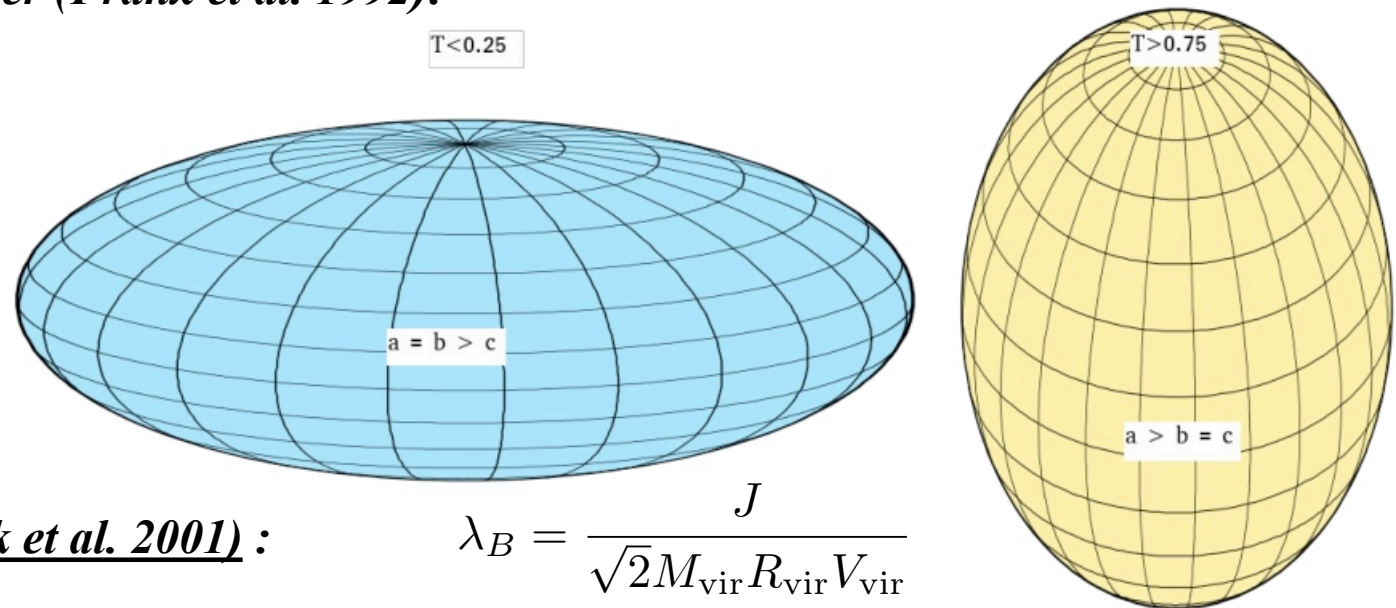
- A variety of isolation status of halos.
- A variety of isolation status of halo pairs ! \longrightarrow DYNAMICS OF PAIRS !

Properties of Interest

- Halo Shape :

- Flatness (c/a)
- Triaxiality parameter (Franx et al. 1992):

$$T = \frac{a^2 - b^2}{a^2 - c^2}$$



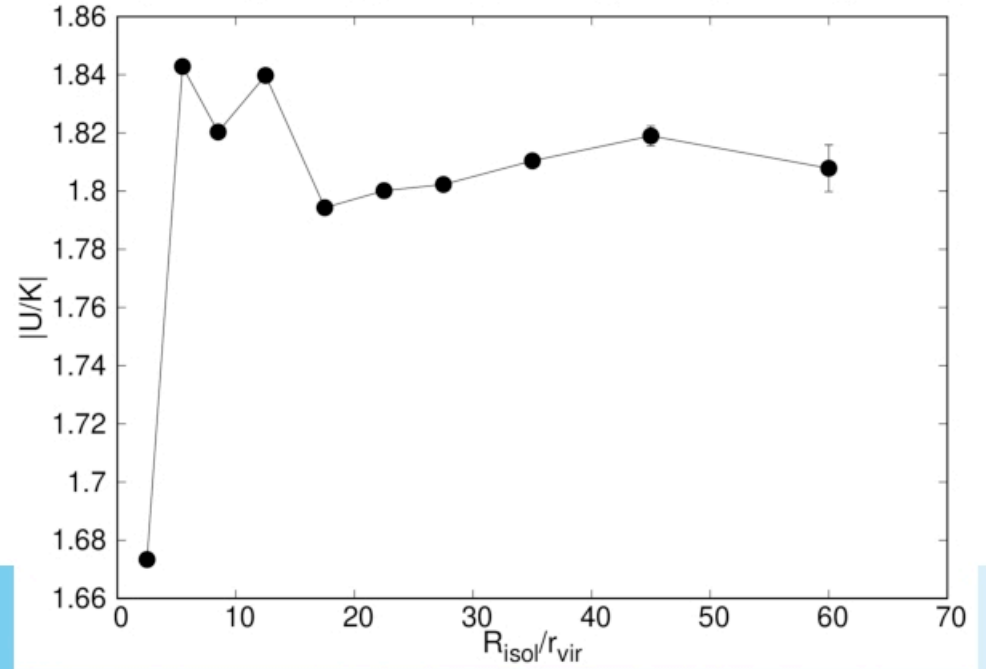
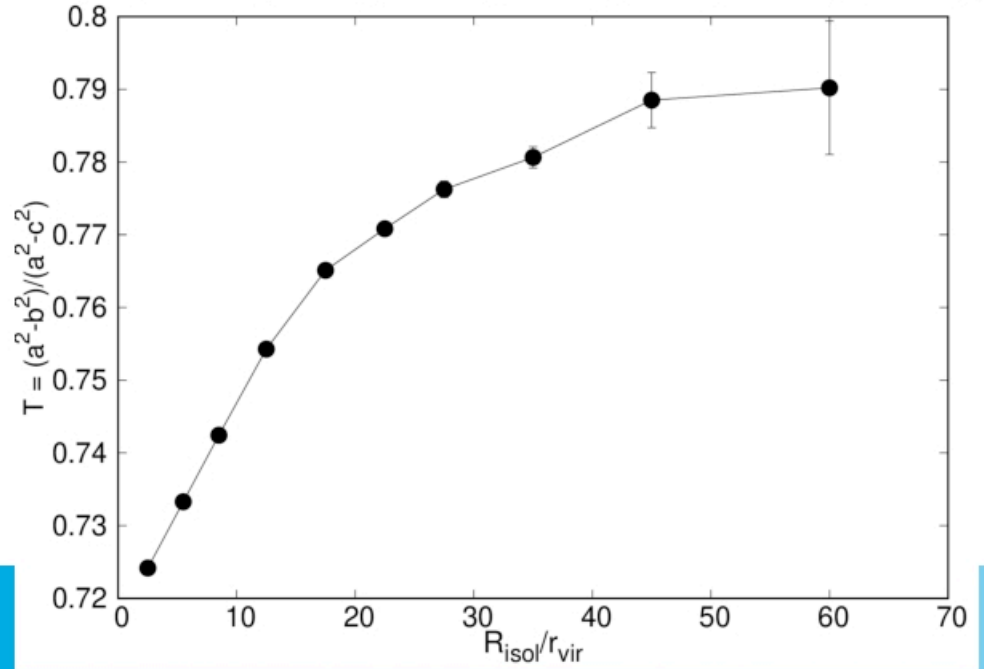
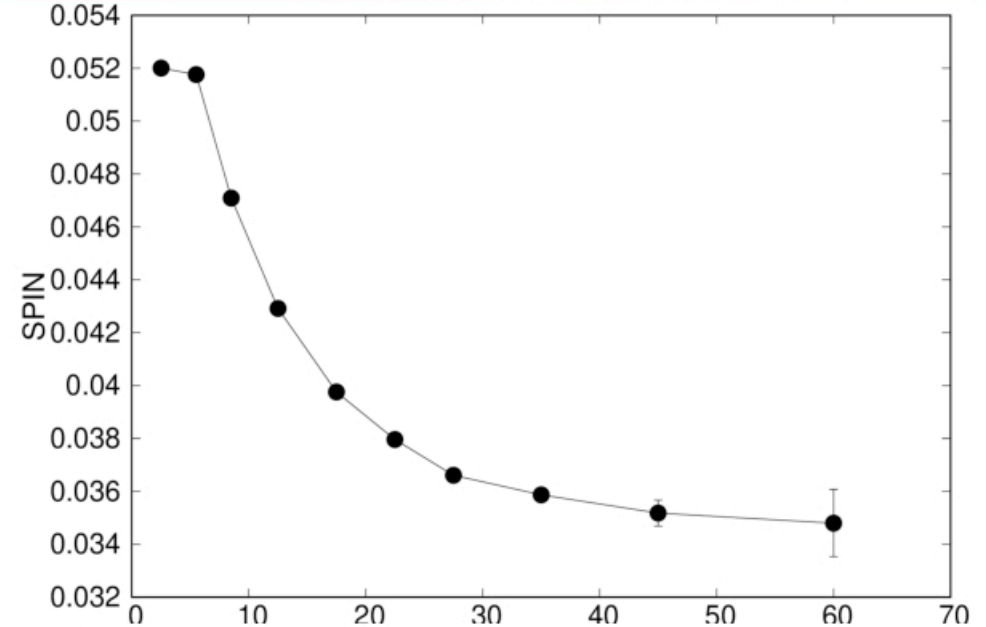
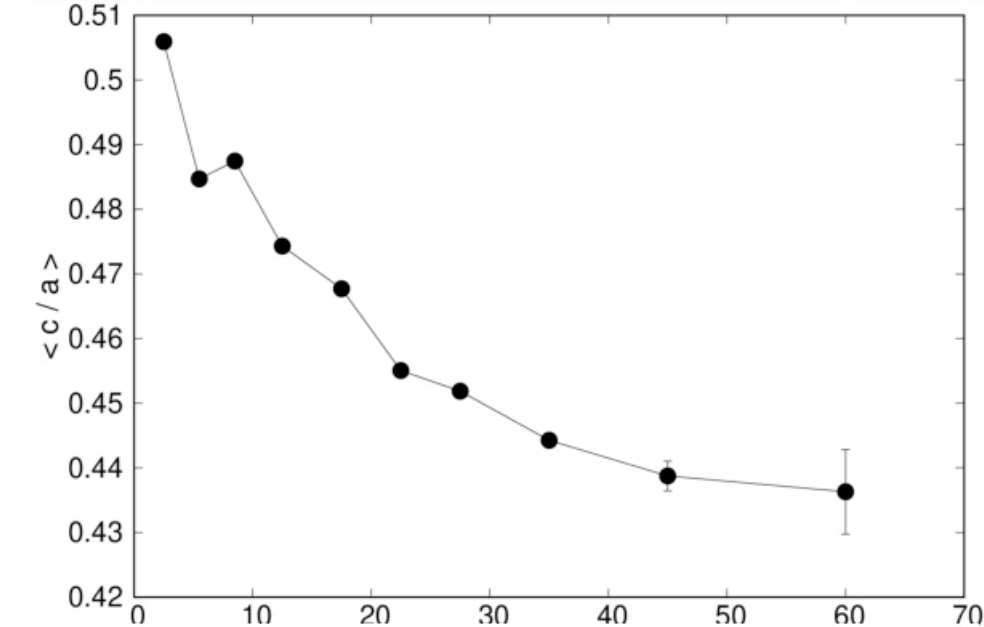
- Spin parameter (Bullock et al. 2001) :

$$\lambda_B = \frac{J}{\sqrt{2}M_{\text{vir}}R_{\text{vir}}V_{\text{vir}}}$$

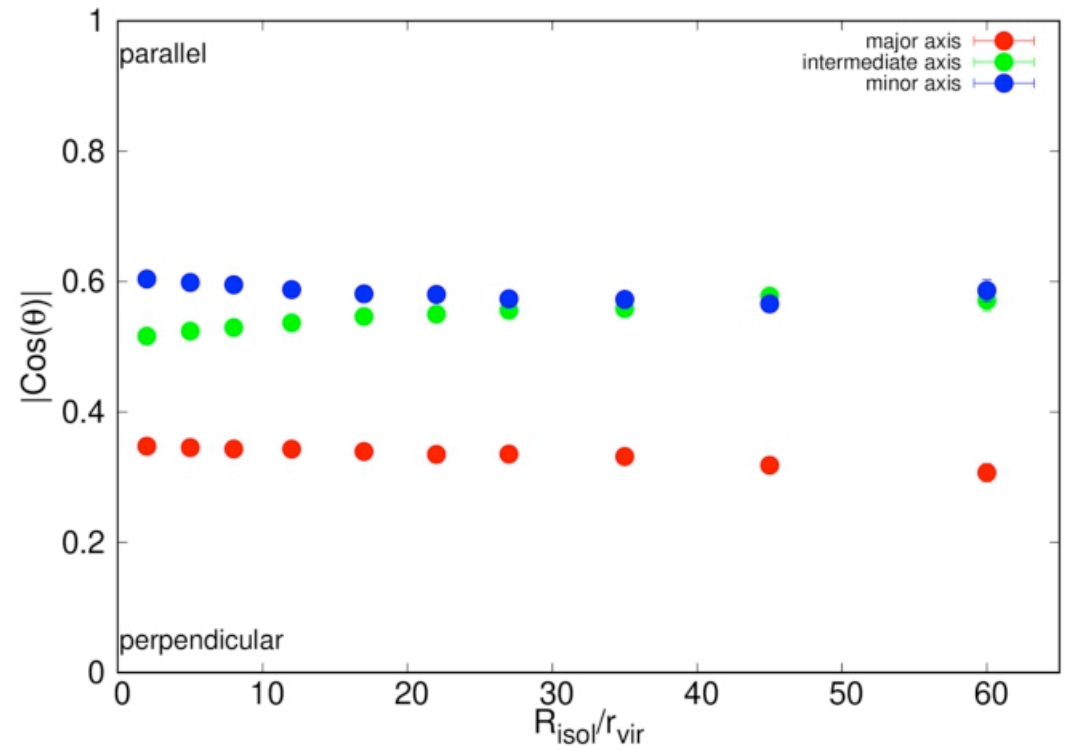
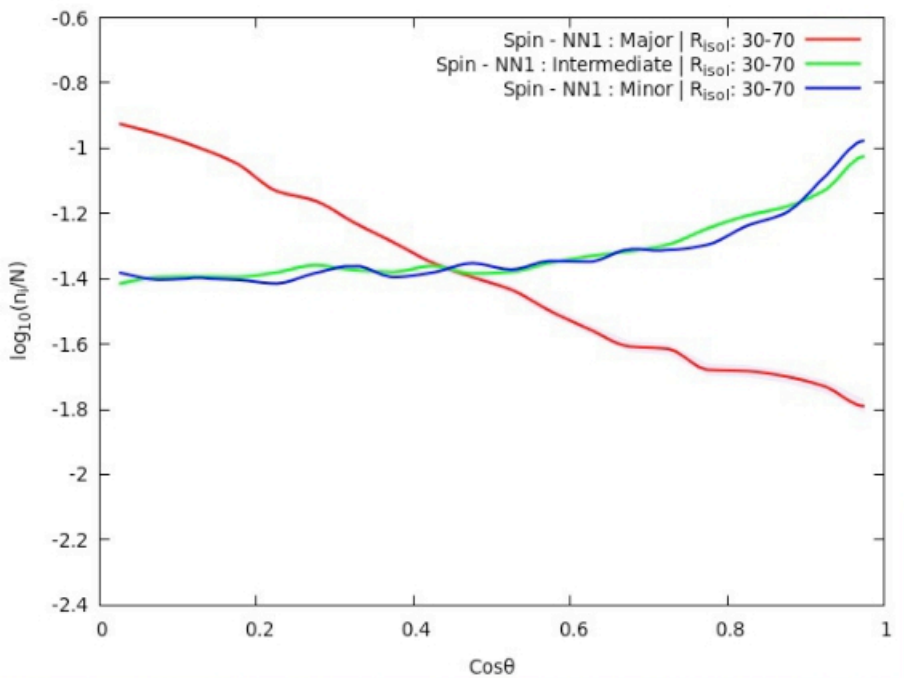
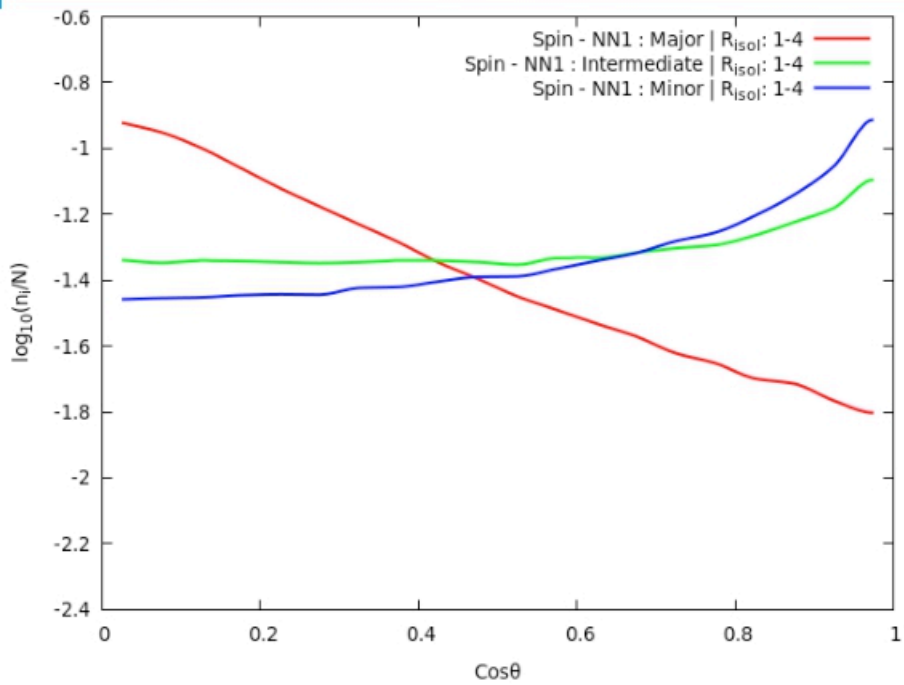
- Virialisation status: comparison with the expectations of the Virial theorem .

$$\left| \frac{U}{K} \right| \simeq 2$$

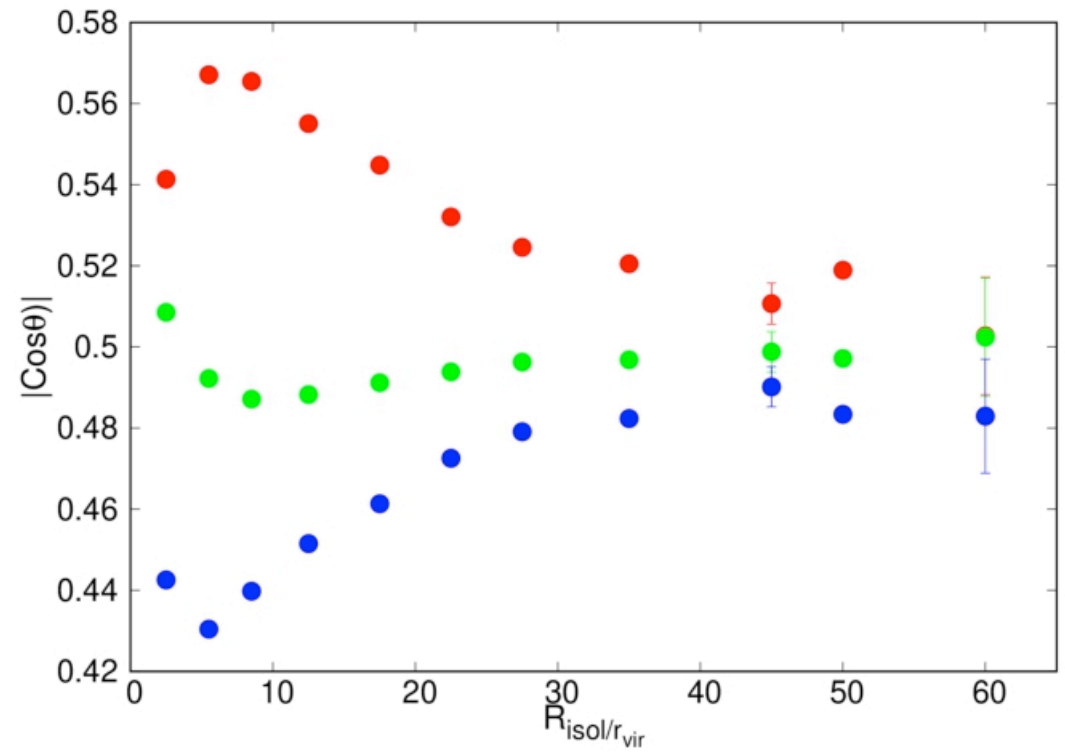
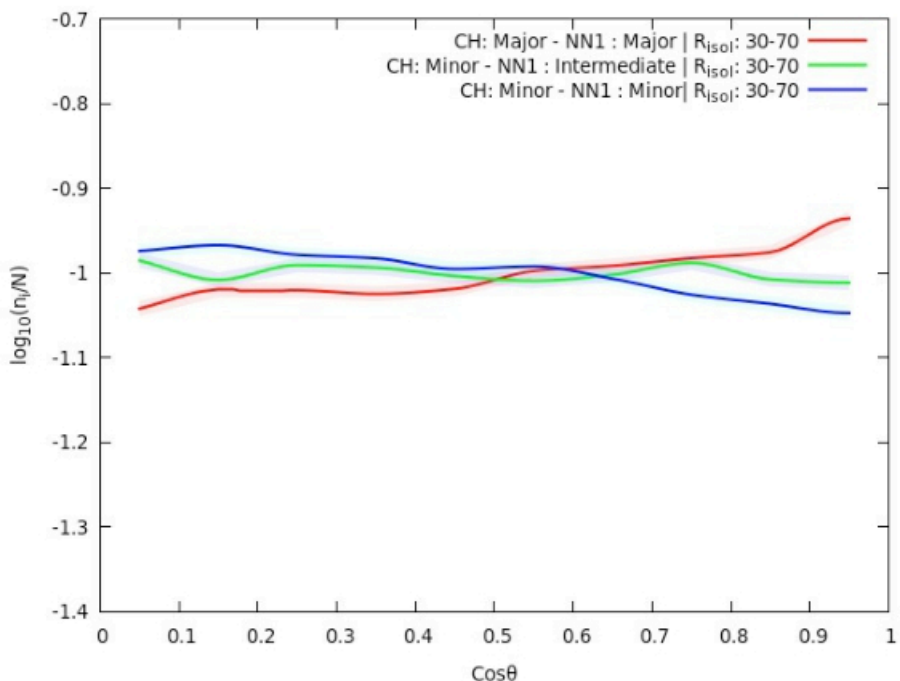
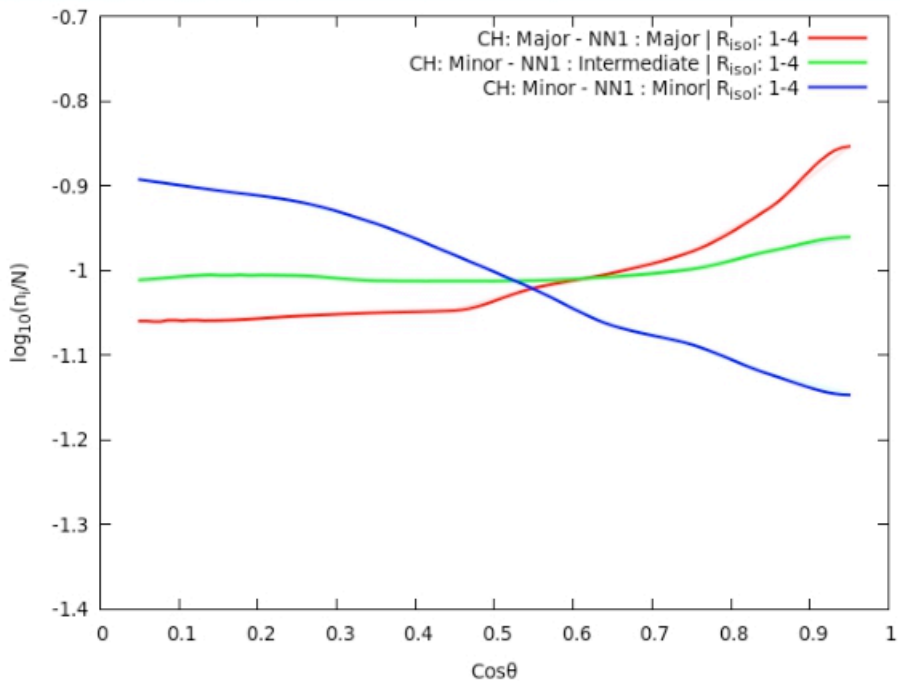
Dependence on the environment



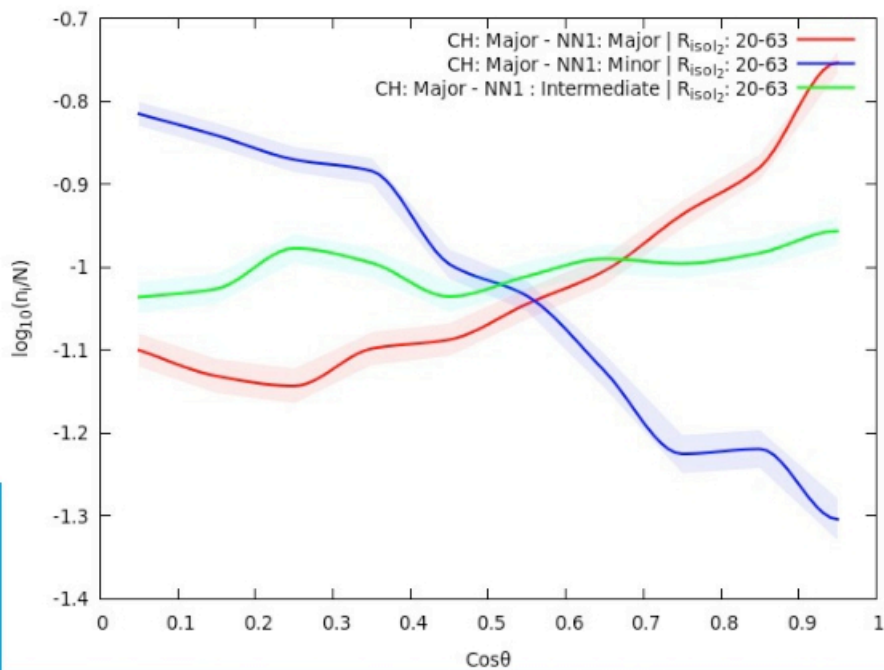
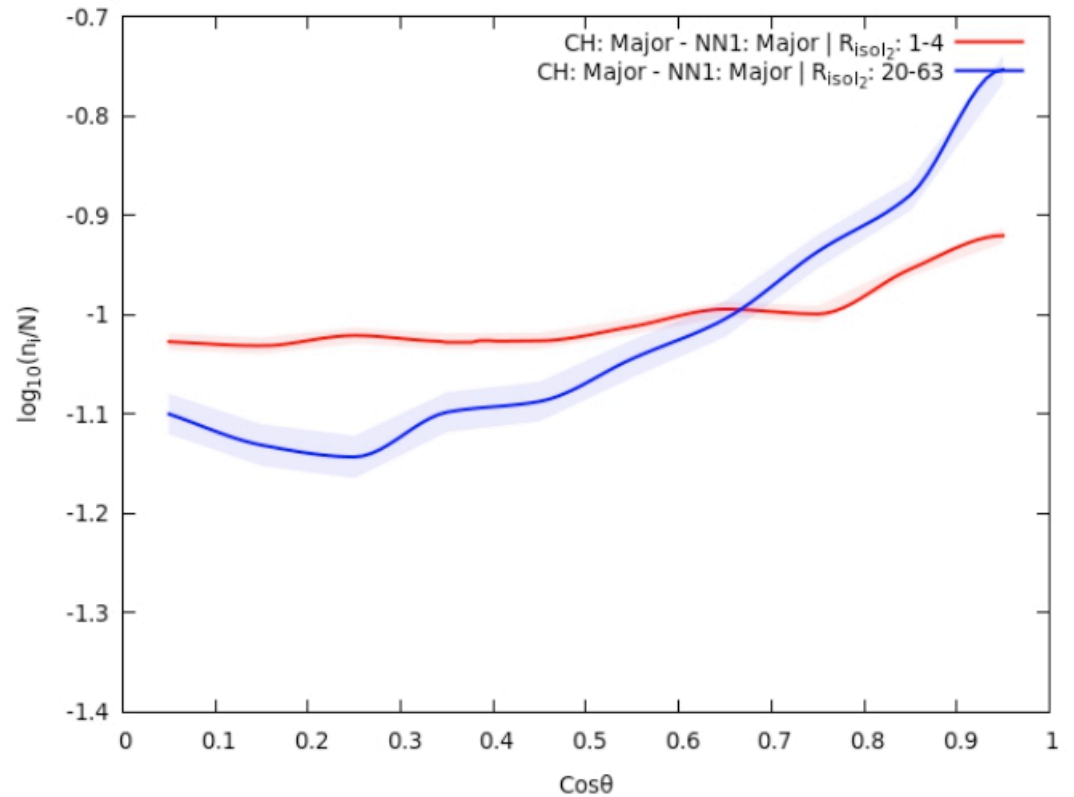
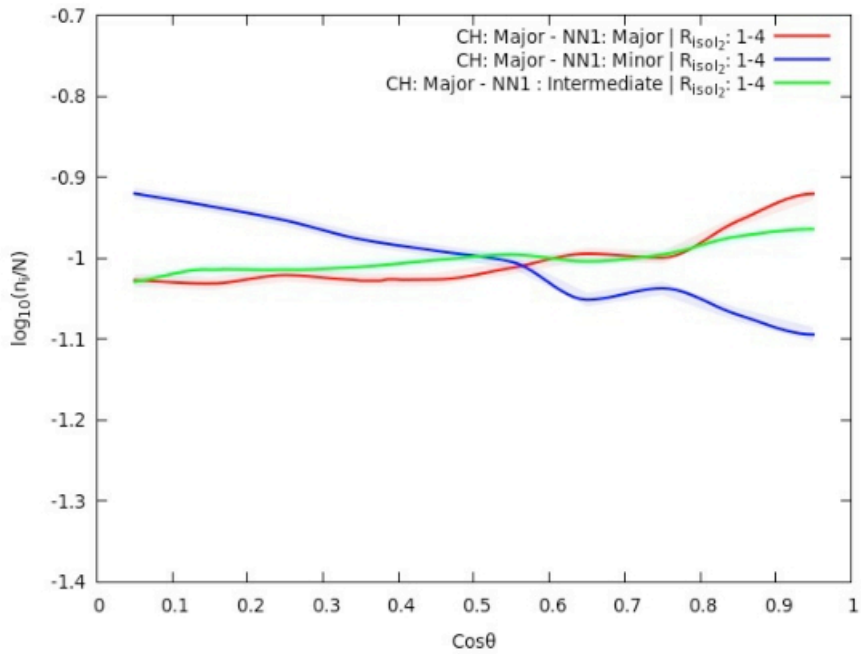
Shape – Spin alignments



Shape – Shape alignments:

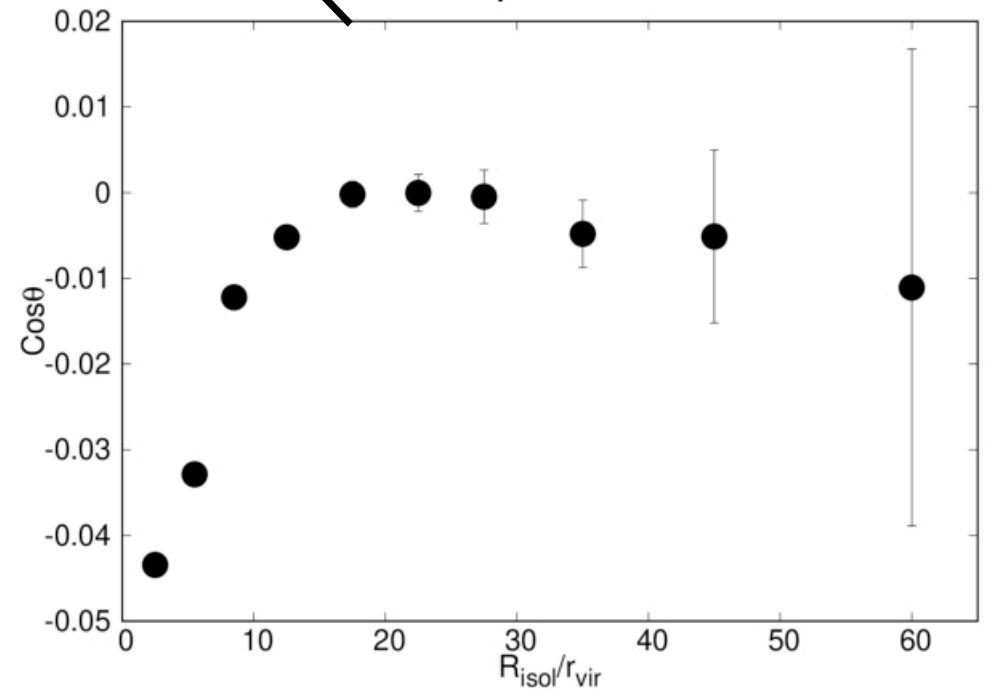
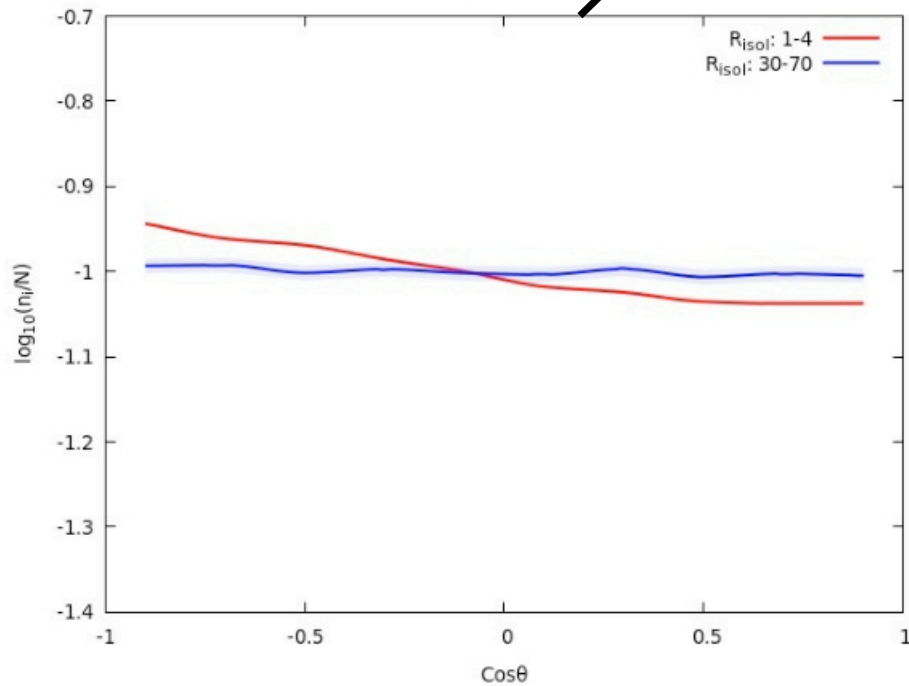


Shape – Shape alignments: pairs

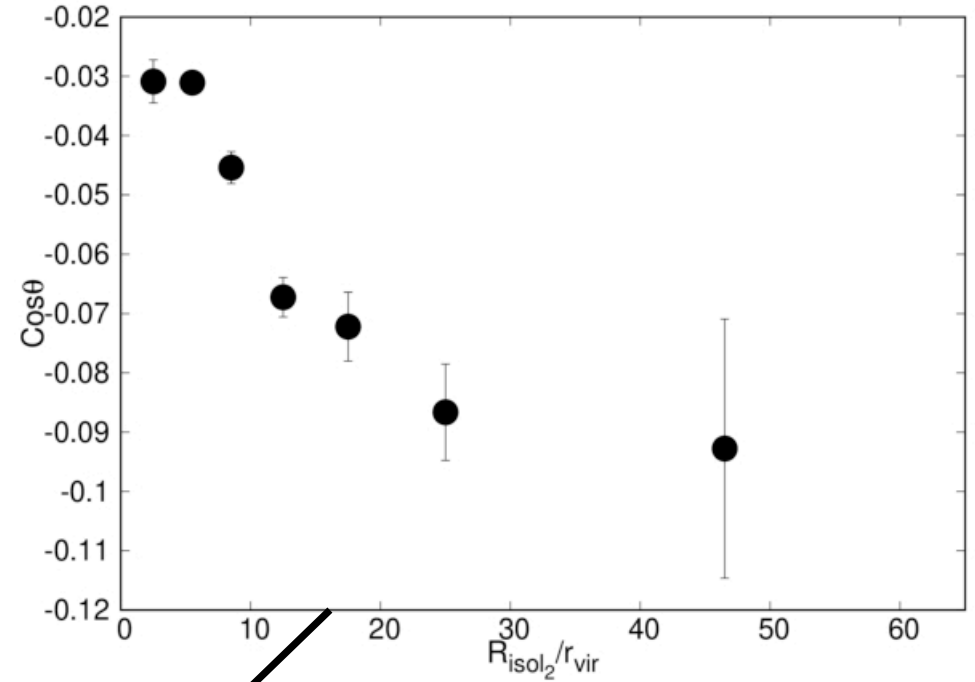
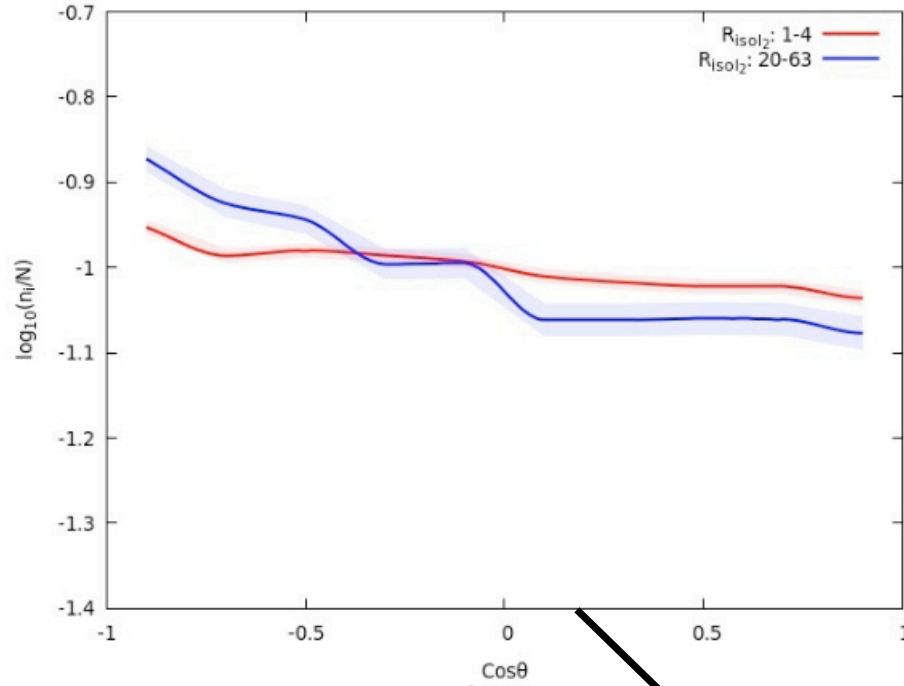


Spin – Spin alignment

Chiral spins of close neighbors???



What about isolated pairs ??



Chirality increases with isolation of the pair!

Conclusions

- Isolated halos are more aspherical and more prolate.
- Spin drops with halo isolation.
- Halos in dense environments are more unvirialised.
- Halo spin is more aligned with the minor axis - no dependence on halo-isolation.
- Close neighbors have their major axes aligned. → alignments enhanced with pair-isolation
- Chirality of spins of close neighbors → enhanced with pair-isolation.

Thank you!

Questions ???