

$$\langle r_0 \rangle_E \equiv \sqrt{\frac{1}{N_{pt}} \sum_{i=1}^{N_{pt}} r_i^2(\vec{a}_0)} = \sqrt{\frac{1}{N_{pt}} \left( \chi_E^2(\vec{a}_0) - \sum_{\alpha=1}^{N_\lambda} \bar{\lambda}_\alpha^2(\vec{a}_0) \right)} \approx \sqrt{\frac{\chi_E^2(\vec{a}_0)}{N_{pt}}}.$$