Microscopic Optical Potentials from Chiral Forces and *Ab Initio* Nuclear Densities

C. Giusti[1], **M. Vorabbi**[2], **P. Finelli**[3]

[1]INFN, Sezione di Pavia, Via A. Bassi 6, I-27100 Pavia, Italy

[2]Department of Physics, University of Surrey, Guildford, GU2 7XH, United Kingdom

[3]Dipartimento di Fisica e Astronomia, Università degli Studi di Bologna and INFN, Sezione di Bologna, Via Irnerio 46, I-40126 Bologna, Italy

In a series of papers [1–7] we derived microscopic optical potentials (OPs) for elastic nucleon-nucleus scattering from chiral interactions at the first order term of the spectator expansion of the Watson multiple scattering theory and adopting the impulse approximation. In [1–3] we adopted the optimum factorization of the two basic ingredients of the model, i.e. the NN t matrix and the nuclear density. Target densities were obtained within the relativistic mean field description. For the NN interaction in the t matrix we used chiral potentials. The agreement of the results of our OPs with experimental data is equivalent to the one obtained with phenomenological OPs [3]. In [4] the folding integral of the NN t matrix and a microscopic nonlocal density obtained with the *ab initio* no-core shell model (NCSM), utilizing NN and $3N$ chiral interactions, was calculated. The same chiral NN interaction is used for the NN t matrix. The OP model was extended to elastic antiprotons-nucleus scattering [5] and of protons off nonzero spin nuclei [6]. The role of the $3N$ interaction in the dynamic part of the OP was investigated in [7].

The NCSM can be used only for nuclei with atomic mass not larger than 16. In general and, in particular, for the study of nuclei away from stability, whose study represents a frontier in nuclear science over the coming years, OPs are required also for heavier nuclei. Recently, our OPs have been extended to heavier targets using nuclear densities from the *ab initio* self-consistent Green's function (SCGF) theory. Numerical results for the observables of elastic proton scattering off Calcium and Nickel isotopic chains are presented and discussed.

References

[1] M. Vorabbi, P. Finelli, and C. Giusti, *Phys. Rev.* **C93** (2016) 034619.

[2] M. Vorabbi, P. Finelli, and C. Giusti, *Phys. Rev.* **C96** (2017) 044001.

[3] M. Vorabbi, P. Finelli, and C. Giusti, *Phys. Rev.* **C98** (2018) 064602.

[4] M. Gennari, M. Vorabbi, A. Calci, and P. Navrátil, *Phys. Rev.* **C97** (2018) 034619.

[5] M. Vorabbi *et al. Phys. Rev. Lett.* **124** (2020) 054606.

[6] M. Vorabbi *et al. Phys. Rev.* **C103** (2021) 024604.

[7] M. Vorabbi *et al. Phys. Rev.* **C105** (2022) 014621.