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From Casimir-Polder Force to Dicke Physics: Interaction between Atoms and a Topological Insulator SEBASTIAN FUCHS, STEFAN BUHMANN, University of Freiburg — We apply the theory of macroscopic quantum electrodynamics in dispersing and absorbing media to study the Casimir-Polder force between an atom and a topological insulator [1]. The electromagnetic response of a topological insulator surface leads to a mixing of electric and magnetic fields, breaking the time-reversal symmetry [2, 3]. The coupling of these fields to an atom causes shifts of the atom's eigenenergies and modified decay rates near the surface of the topological insulator. Energy shifts and modified decay rates cannot only be triggered by the presence of a material, but can be caused by other atoms in close proximity as well. The collective dynamics of atoms (Dicke Physics) leads to a superradiant burst [4]. Combining macroscopic QED and Dicke physics opens the door to the investigation of cooperative atom-surface interactions. [1] S. Y. Buhmann, Dispersion Forces II, Springer-Verlag Berlin Heidelberg (2012). [2] S. Y. Buhmann, D. T. Butcher, and S. Scheel, New Journal of Physics 14, 083034 (2012). [3] J. A. Crosse, S. Fuchs, and S. Y. Buhmann, arXiv: 1509.03012 (2015). [4] S. Fuchs, J. Ankerhold, M. Blencowe, and B. Kubala, arXiv: 1501.07841 (2015).

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