

Is the CISS Effect a Special Case of Emergent Magnetization at Metal–Molecule Interfaces?

O. L. A. Monti,¹ A. Sharoni,² and Y. Dubi^{3,+}

¹ Depts. of Chemistry and Physics, University of Arizona, Tucson, AZ 85721, USA

² Department of Physics, Bar-Ilan University, Ramat Gan 5290002, Israel

³ Dept. of Chemistry, Ben-Gurion University of the Negev, Beer Sheva 8410501, Israel

Chirality-induced spin selectivity (CISS) is the magnetically non-trivial electronic response of chiral molecules: the current through a chiral molecular junction depends on the magnetization of a ferromagnetic electrode and on handedness, and electrons photoemitted through a chiral layer emerge spin-polarized, with a sign set by handedness [1]. The effect is large and survives at room temperature. The origin of the CISS effect is a major open question, but experimental evidence points strongly to an interface effect [2].

The “Spinterface mechanism” [1,3] suggests that the CISS is an interface phenomena. It relies on an assumption (motivated by the appearance of magnetization in metal-molecule hybrid systems discussed above) that the interface between the metal and molecule gives rise to some localized magnetic moment, whose direction is undetermined. The adsorption of a chiral molecule drives a transient charge redistribution in a chiral environment, accompanied by a pulse of magnetic field along the chiral axis; with exchange coupling and dissipation into the metal, this stabilizes the fluctuating surface moments along that axis. This is the only theoretical approach to CISS that permits *direct fitting of raw experimental data* [3].

This is not the only magnetic effect arising in hybrid metal-molecule interfaces. In fact, evidence for magnetic effects in hybrid interfaces with *achiral* molecules is over two decades old [4]. And yet, to the best of our knowledge, no one in the CISS or other community has made the connection between the two.

In this talk we demonstrate that the “spinterface mechanism” provides a direct and natural link between these two families of phenomena. The magnetism arises from the same reasons, namely the presence of magnetic moments at the metal-molecule interface, and chirality is a *director* for the effect, supplying an out-of-plane advantage that prevents cancellation that typically washes out the effect in achiral molecules. Thus, CISS may thus be a legible case of emergent interfacial magnetization, and not a unique effect.

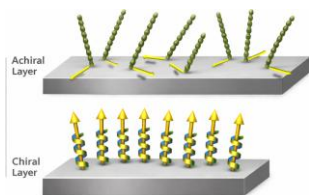


Figure 1. Adsorption-stabilized surface moments (arrows). For an achiral layer (top) they lie in the interface plane and average to zero; for a chiral layer (bottom) they align with the chiral axis and survive averaging.

[1] S. Sarkar, A. Sharoni, O. L. A. Monti, and Y. Dubi, ACS Nano 19, 37484 (2025).

[2] Nguyen et al., Chem. Sci. 15, 14905 (2024); Aragón et al., JACS 147, 36453 (2025).

[3] O. L. A. Monti and Y. Dubi, JACS 146, 32795 (2024); S. Alwan and Y. Dubi, JACS 143, 14235 (2021).

[4] I. Carmeli et al., J. Chem. Phys. 118, 10372 (2003); M. Baljović et al., ACS Nano 20, 4143 (2026).

+ Author for correspondence: jdubi@bgu.ac.il