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SPIRE, the "Spin Triangle": Athens, Hamburg, Buenos Aires: Advancing Nanospintronics and Nanomagnetism[1]

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Future technological advances at the frontier of 'elec'tronics will increasingly rely on the use of the spin property of the electron at ever smaller length scales. As a result, it is critical to make substantial efforts towards understanding and ultimately controlling spin and magnetism at the nanoscale. In SPIRE, the goal is to achieve these important scientific advancements through a unique combination of experimental and theoretical techniques, as well as complementary expertise and coherent efforts across three continents. The key experimental tool of choice is spin-polarized scanning tunneling microscopy – the premier method for accessing the spin structure of surfaces and nanostructures with resolution down to the atomic scale. At the same time, atom and molecule deposition and manipulation schemes are added in order to both atomically engineer, and precisely investigate, novel nanoscale spin structures. These efforts are being applied to an array of physical systems, including single magnetic atomic layers, self-assembled 2-D molecular arrays, single adatoms and molecules, and alloyed spintronic materials. Efforts are aimed at exploring complex spin structures and phenomena occurring in these systems. At the same time, the problems are approached, and in some cases guided, by the use of leading theoretical tools, including analytical approaches such as renormalization group theory, and computational approaches such as first principles density functional theory. The scientific goals of the project are achieved by a collaborative effort with the international partners, engaging students at all levels who, through their research experiences both at home and abroad, gain international research outlooks as well as understandings of cultural differences, by working on intriguing problems of mutual interest. A novel scientific journalism internship program based at Ohio University furthers the project's broader impacts.

[1]The NSF PIRE program is gratefully acknowledged.