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Large and inverted spin signals in nonlocal spin valves YI JI, HAN ZOU, SIU-TAT CHUI, XIAOJUN WANG, University of Delaware — For a metallic nonlocal spin valve (NLSV), usually the nonlocal resistance value is high for the parallel (P) state of spin injector and detector and the value is low for the antiparallel (AP) state. The difference between two states is known as the spin signal. We show that a 6 miliohms spin signal was observed in a typical NLSV device. However, in another NLSV device with apparently similar structure and dimensions as the previous one, we found a very large spin signal of 90 milliohms with an inverted sign, meaning that the P state yields a low value and the AP state yields a high value. The resistance between the spin detector and the Cu channel is extremely large, exceeding mega-ohms. We conclude that a break-junction is formed at the detector/Cu interface due to static discharge. The large magnitude of the spin signal is due to the spin-charge coupling at the low-conductance break-junction interface. The inverted sign is due to a very different spin-dependent density of states near the break-junction. Work supported by DOE grant No. DE-FG02-07ER46374.

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