

Abstract Submitted  
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**Anomalous High-Energy Spin Excitations in the High- $T_c$  Superconductor Parent Antiferromagnet  $\text{La}_2\text{CuO}_4$**  STEPHEN HAYDEN, NEIL HEADINGS, University of Bristol, RADU COLDEA, University of Oxford, TOBY PERRING, Rutherford Appleton Laboratory — Inelastic neutron scattering is used to investigate the collective magnetic excitations of the high-temperature superconductor parent antiferromagnet  $\text{La}_2\text{CuO}_4$ . We find that while the lower energy excitations are well described by spin-wave theory, including one- and two-magnon scattering processes, the high-energy spin waves are strongly damped near the  $(1/2,0)$  position in reciprocal space and merge into a momentum dependent continuum. This anomalous damping indicates the decay of spin waves into other excitations, possibly unbound spinon pairs. The spinon dispersion that can explain the observed spin-wave damping in our experiments has the same form as the pseudogap dispersion observed in superconducting cuprates, with a minimum at  $(1/4,1/4)$ .

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