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**Polarised neutron study of the "even" and "odd" magnetic excitations in $YBa_2Cu_3O_{6.9}$** CHRISTOPHER LESTER, STEPHEN HAYDEN, University of Bristol, JIRI KULDA, Institut Laue-Langevin, DAVID CARDWELL, NADENDLA HARI BABU, University of Cambridge — On cooling through $T_c$, the spin excitation spectra of cuprate superconductors becomes dominated by the neutron spin resonance (NSR), a collective mode centred at $\mathbf{Q_{AF}}$. We have used polarized inelastic neutron scattering to measure the spin excitations of $YBa_2Cu_3O_{6.9}$ ($T_c$ =93 K), unequivocally confirming the magnetic character of the NSR in both the odd and even channels. In the odd channel, the NSR is anisotropic in spin space, that is the out of plane ($c$) component of $\chi''(\mathbf{Q},\omega)$ is approximately 1.4 times larger than the in-plane ($a/b$) component. Conversely, the much weaker even channel resonance is isotropic to within experimental error, and the low energy response maintains a large gap (below $\sim$30 meV) in the normal state. While it is generally accepted that the NSR is ubiquitous in at least the hole-doped cuprates, recently two further collective modes have been observed in $HgBa_2CuO_{4+\delta}$. If these weakly-dispersive "Ising-like" modes were also universally present, then they might radically alter our view of the cuprate superconducting state. However, we find no evidence of this type of excitation in $YBa_2Cu_3O_{6.9}$, suggesting that these modes may in fact be unique to certain systems.

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