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Substitution effects in the spin-gap compound BiCu$_2$PO$_6$\textsuperscript{1} A.V. MAHAJAN, B. KOTESWARA RAO, Dept. of Physics, IIT Bombay, J. BOBROFF, Labo. de Physique des Solides, Orsay, France — BiCu$_2$PO$_6$ has a structure where the Cu spins appear to form a two-leg ladder. From our susceptibility measurements, we indeed find an exponential decrease of the spin-susceptibility ($\chi_{\text{spin}}(T)$) below a broad maximum with a spin-gap ($\Delta$) of about 40 K. Analysis of $\chi_{\text{spin}}(T)$ indicates that the leg and rung exchange couplings are nearly equal and further that the inter-ladder coupling is not negligible. No long-range order was observed down to 1.8 K. Heat capacity measurements yield $\Delta \approx 40$ K. Isovalent substitutions (Zn and Ni) at the Cu site destroy the spin-gap and induce a transition to a spin-glass/disordered magnetic state below about 5 K, as seen from our susceptibility, heat capacity, and $\mu$SR data. Heterovalent substitutions (Pb, Sr) at the Bi site, which should release one hole per substituent, do not significantly change the magnetic behavior other than a low-T Curie term in the susceptibility. On the other hand, Na doping (which should give rise to two holes per Na) gives rise to an additional peak in $\chi_{\text{spin}}(T)$ at about 20 K, below the broad maximum at 60 K. The nature of this transition is currently being investigated.

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A.V. Mahajan
Dept. of Physics, IIT Bombay

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