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Co-existence of *ac* and *bc*-cycloidal phases, giant magnetocapacitance and polarization in the multiferroic $R_{0.5}Dy_{0.5}MnO_3$ ($R = Eu$ and Gd) SUNDARESAN ATHINARAYANAN, CHANDAN DE, Jawaharlal Nehru Ctr Adv Sci — In the cycloidal $RMnO_3$ ($R = Tb$ and Dy) multiferroic compounds, the cycloidal spin propagates along the *bc* plane and polarization appears along *c*-direction. In the case of $GdMnO_3$, it appears that the cycloidal plane is along the *ab* plane and the polarization points in the *a*-direction. In my talk, I will demonstrate the emergence of these two cycloidal ordered phases with temperature and their co-existence from the measurements of pyroelectric current and dielectric properties in mixed rare-earth compounds, $Eu_{0.5}Dy_{0.5}MnO_3$ and $Gd_{0.5}Dy_{0.5}MnO_3$. The obtained value of polarization is in the same order of magnitude as in the E-type magnetic multiferroic ($HoMnO_3$). Further, these compound show giant magnetic field enhancement of ferroelectric polarization (up to +150% in $Gd_{0.5}Dy_{0.5}MnO_3$) in contrast to $TbMnO_3$ (up to -10%). Also, the value of magneto-capacitance is nearly twenty times higher than that of $TbMnO_3$. We attribute this high value of polarization and magneto-capacitance to the coexistence of *ab* and *bc* cycloidal phases. The isothermal current observed upon change of magnetic field with time, demonstrates giant magnetoelectric coupling for a number of cycle without any training effect.

Sundaresan Athianarayanan
Jawaharlal Nehru Ctr Adv Sci

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