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**Magnetic gradiometer array operating in closed-loop mode**

NICHOLAS NARDELLI, ABIGAIL PERRY, SEAN KRZYZEWSKI, BRANISLAV KORENKO, SVENJA KNAPPE, Univ of Colorado - Boulder — We report on the development of a multichannel magnetic imaging system consisting of 24 gradiometers for use in magnetoencephalography. Each gradiometer consists of two chip-scale atomic magnetometers separated by 2 cm, operating in the spin-exchange relaxation free (SERF) regime. They share a laser beam for pumping and probing to reduce the common mode noise from the laser, and atomic vapor pressure is independently controlled by optically heating at telecom wavelength. Most SERF atomic magnetometers operate in open-loop mode but we operate our system in closed-loop mode where we maintain the magnetometer at zero field by feeding back the magnetic error signal onto a set of coils. This increases the stability of the system as well as increasing the common-mode rejection of the gradiometer. Operating in closed-loop also increases the dynamic sensing range since the feedback keeps the magnetometers functioning within the linear range of the dispersion. Working simultaneously, the gradiometers achieve sensitivities ranging from 10 - 13 fT/Hz<sup>1/2</sup> and are able to function in the presence of background fields up to 70 nT. We are investigating the role that cross-talk plays in limiting the sensitivity of the system which may limit the possible gradiometer density

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