Internal Alfvén eigenmode observations on DIII-D

M.A. Van Zeeland,[a] M.E. Austin,[b] T.N. Carlstrom, T. Deterly,[c] D.K. Finkenthal,[c] G.J. Kramer,[d] M.A. Makowski,[e] G.R. McKee,[f] R. Nazikian,[d] W.A. Peebles,[g] T.L. Rhodes,[g] W.M. Solomon,[d] E.J. Strait

General Atomics, P.O. Box 85608, San Diego, California 92186-5608, USA

[a] *Oak Ridge Institute for Science Education, Oak Ridge, Tennessee, USA*

[b] *University of Texas at Austin, Austin, Texas, USA*

[c] *Palomar College, San Marcus, California, USA*

[d] *Princeton Plasma Physics Laboratory, Princeton, New Jersey, USA*

[e] *Lawrence Livermore National Laboratory, Livermore, California, USA*

[f] *University of Wisconsin, Madison, Wisconsin, USA*

[g] *University of California-Los Angeles, Los Angeles, California, USA*

[*] *o whom correspondence should be addressed (vanzeeland@fusion.gat.com)*

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Abstract. Recent upgrades to many of the diagnostic systems on DIII-D [J.L. Luxon, Nucl. Fusion **42**, 614 (2002)] such as the CO_2 interferometer, far-infrared scattering, beam-emission spectroscopy, and quadrature reflectometer have significantly extended their capabilities and made possible the experimental study of Alfvén eigenmodes (AEs) through observation of the AE induced density perturbation. Measurements have revealed the presence of several different classes of AEs in DIII-D discharges including the toroidal Alfvén eigenmode (TAE), reverse shear Alfvén eigenmode (RSAE or Alfvén cascade), and ellipticity induced Alfvén eigenmode (EAE). Based on a simple model for the RSAE frequency, a sensitive diagnostic for the evolution of the minimum magnetic safety factor (q_{min}) is presented and results are compared with motional Stark effect (MSE) measurements. Strong localization of high toroidal mode number RSAEs to regions near the minimum of the magnetic safety factor is exhibited on CO_2 interferometer and beam emission spectroscopy (BES) measurements. Based on this observation, a method for providing constraints on the radial location of q_{min} is demonstrated and a favorable comparison to MSE measurements is made. Detailed measurements of TAEs using a new all-digital large bandwidth two-color CO_2 interferometer system show a strong asymmetry between vertical and radial viewing interferometer chords confirming previously reported results. Additionally, effects related to line-integrated observations are clearly illustrated by comparison to local BES measurements and potential issues related to this are discussed.

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