# Overview of the Basic Plasma Science Facility: the physics of waves relevant to space, astrophysical and fusion plasmas

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The Basic Plasma Science Facility (BaPSF) at UCLA is a US national user facility for studies of fundamental processes in magnetized plasmas. The centerpiece of the facility is the Large Plasma Device (LAPD), a 20m long, magnetized linear plasma device [1]. This LAPD has been utilized to study a number of fundamental processes, including: collisionless shocks [2], dispersion and damping of kinetic and inertial Alfvén waves [3], flux ropes and magnetic reconnection [4], three-wave interactions and parametric instabilities of Alfvén waves [5], turbulence and transport [6] and interactions of energetic ions and electrons with plasma waves [7]. A brief overview of research using the facility will be given, followed by a more detailed discussion of studies of the nonlinear physics of Alfvén waves [8]. Recent experiments have resulted in the first laboratory observation of the parametric instability of shear Alfvén waves. Shear waves with sufficiently high $\omega/\Omega_{c,i}$ ($> 0.6$) and above a threshold wave amplitude are observed to decay into co-propagating daughter waves; one a shear Alfvén wave and the other a low-frequency quasimode. The observed process is similar to the modulational decay instability.

## References

[1] W. Gekelman, et al., Review of Scientific Instruments **87**, 025105 (2016).

[2] A.S. Bondarenko, et al., Nature Physics **13**, 573 (2017).

[3] C.A. Kletzing, et al., Phys. Rev. Lett. **104**, 095001 (2010).

[4] W. Gekelman, et al., Phys. Rev. Lett. **116**, 235101 (2016).

[5] G. Howes, et al., Phys. Rev. Lett. **109**, 255001 (2012).

[6] D.A. Schaffner, et al., Phys. Rev. Lett. **109**, 135002 (2012).

[7] B. Van Compernolle, et al., Phys. Rev. Lett. **114**, 245002 (2015).

[8] S. Dorfman and T.A. Carter, Phys. Rev. Lett. **116**, 195002 (2016).