Guest Editorial  
The 17th Special Issue on  
High Power Microwave Generation

The publication of this 17th Special Issue on High Power Microwave (HPM) Generation continues a series first published in December 1985. Since the first volume, the entire HPM field has undergone tremendous changes and advances. While initially being work done in government institutions, research now spans the range of academic institutions, corporate research groups, and government laboratories from across the world. The subject areas addressed have evolved, as well. In 1985, the topics spanned five categories: 1) gyrotrons and cyclotron-resonance devices; 2) free-electron lasers; 3) virtual-cathode and reflex oscillators; 4) Cerenkov radiation generators; and 5) magnetrons, klystrons, and backward-wave oscillators. These areas still remain active areas of research interest, now augmented by the rapid advance of particle-in-cell codes and electromagnetic solvers as tools to model and help understand HPM devices.

In the 16th edition, we saw the inclusion of two emerging areas in HPM research, and metamaterials and additive manufacturing. Collectively, these two areas still hold the promise of revolutionizing HPM. However, the current 17th HPM Special Issue returns to one of the basics from the original 1985 Special Issue: Gyrotrons. Gyrotrons comprise a unique family of HPM devices. These vacuum electron devices operate by utilizing the stimulated cyclotron emission of electrons that propagate in a strong magnetic field. Unlike most HPM sources, these tubes operate in a highly over-moded configuration, which can lead to both high-frequency operations, from gigahertz to terahertz bands, with high power generation. Gyrotrons are uniquely tunable, with an operating frequency dictated by the applied magnetic field. The importance of gyrotrons cannot be underestimated. These HPM sources find application in areas ranging from dynamic nuclear polarization nuclear magnetic resonance spectroscopy to fusion plasma heating to radars to materials processing to defense applications. As such, the gyrotron remains one of the most versatile HPM devices.

This volume represents the continued high quality as well as scientific breadth and depth of the HPM field. This quality comes as a result of a community effort, ranging from funding agencies to individual researchers to the IEEE Plasma Sciences Community. The editors wish to thank all the contributors to this Special Issue, as well as those many individuals who graciously gave of their time and effort to review manuscripts over the course of the last year. The professionalism of both reviewers and authors has made this a truly rewarding experience. The Guest Editors would also like to thank Dr. Don Shiffler and Dr. Steve Gitomer for their advice and support throughout this process, and most importantly, the IEEE Editorial Staff. Without the work of people such as Margie Rafferty, and her extraordinary patience, this Special Issue would not be possible.

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