# Pushing the Limits of RF Superconductivity

Argonne National Laboratory
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Session 1: Ultimate Field Limits, New Materials, New Geometries

# Summary

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# Scooped Again!

- Outstanding reviews of the technical content by Peter and Helen earlier today

# Review of Contributions

- **Ilan Ben-Zvi:** development of a 1 amp photocathode SC cavity for FEL application
- **Ricky Campisi:** advantages of evaluating new materials using fast-pulsed, high-power measurements of the SC properties of small samples
- **Jean Delayen:** a large variety of geometries have been and continue to be developed for low- & medium-β applications, current performance limits and issues
- **Rong-Li Geng:** re-entrant cavity geometry reduces peak RF magnetic field and may permit operation at 50 MV/m
- **Alex Gurevich:** theoretical aspects of limiting rf behavior in superconductors
- **Charlie Reece:** two cavity geometries in final JLab upgrade prototype offer improvements in peak field and shunt impedance
- **Waldemar Singer:** Nb-clad Cu (explosively bonded and hot-rolled) single-cell cavities produced $E_{acc}$ up to 40 MV/m
- **Tsuyoshi Tajima:** new materials at LANL and collaborating laboratories, including some interesting and promising results with $MgB_2$.
- **Genfa Wu:** Nb, $Nb_3Sn$ and $MgB_2$ thin films

# The Moderators' Views - I

- For Nb, magnetic fields now seem to be the limit (both high-beta and low-beta structures)
- Improvements are at the margins (very important, but not going to change 'big picture' conclusions):
  - New materials may become available, but much work needs to be done to establish operational limits
  - New techniques with niobium (sputtered film, bulk Nb bonded to Cu) are viable alternatives to bulk Nb that can offer advantages for some applications, but will impact cost more than performance
  - Tweaking the cavity designs can provide 10-20% performance gains
  - Tweaking bulk Nb properties can also provide 10-20% performance gains

# The Moderators' Views - II

- Focus of workshop is limiting gradients (ILC); other applications (cw) require other optimizations – not equivalent, but complementary
- Innovative approaches to analyzing and diagnosing superconducting surfaces are greatly needed – both for fundamental physics and for QA
- Caution is required in claiming high gradients without reference to associated RF losses at the operating gradient