GaN HEMTs and Amps

Device Structure

- Gated region
- Un-gated region
- Schottky
- Ohmic
- 2-DEG
- Nucleation
- S.I. GaN
- Substrate
- AlGaN
**GaN-Based HEMTs and Amps**

**Polarization Effect**

1. **Strictly no bulk & surface donors**
   - $\Delta E_C$
   - $\phi_{sk}$
   - $E_F$
   - $E_s$
   - $\text{AlGaN}$
   - $\text{GaN}$

2. **Gate region**
   - $\Delta E_C$
   - $E_F$
   - $E_s$
   - $\text{AlGaN}$
   - $\text{GaN}$

3. **With surface trap/donors**
   - $\Delta E_C$
   - $E_F$
   - $E_s$
   - $\text{AlGaN}$
   - $\text{GaN}$

4. **With Si-doping in the AlGaN**
   - $\Delta E_C$
   - $E_F$
   - $E_s$
   - $\text{AlGaN}$
   - $\text{GaN}$

Adding gate metal
GaN-Based HEMTs and Amps

Benefit of higher Al content

- Higher $\Delta E_C$
  higher charge, lower on resistance
- Higher Shottky gate barrier
  resistance to high temperature
- Higher bandgap in the AlGaN
  increased breakdown field
Dispersion---trapping effect

GaN-Based HEMTs and Amps

Reduced dispersion