Effect of Magnetic Configuration on Energy Confinement and Energetic-Particle-Driven MHD Modes in Heliotron J

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Effect of bumpiness

- The stored energy is maximal in the medium-bumpiness configuration in which neoclassical transport is reduced.

\[ \varepsilon_b = 0.22 \text{(Ultra high)} \]
\[ \varepsilon_b = 0.19 \text{(Very high)} \]
\[ \varepsilon_b = 0.15 \text{(High)} \]
\[ \varepsilon_b = 0.06 \text{(STD)} \]
\[ \varepsilon_b = 0.01 \text{(Low)} \]

<table>
<thead>
<tr>
<th>( W_b/n_e ) ( \times 10^{-19} \text{ kJ m}^{-3} )</th>
<th>( \varepsilon_b )</th>
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<tbody>
<tr>
<td>ECH-only plasma</td>
<td>( \varepsilon_b = 0.22 )</td>
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</table>
| \( P\text{EC} = 250 \text{ kW} \) \( n_e = 1.0 - 1.2 \times 10^{19} \text{ m}^{-3} \) |}

Energetic-Particle-Driven MHD Modes

- The \( n/m=1/2 \) EPM & \( n/m=2/4 \) GAE are successfully reproduced by MEGA code.
- Some EP-driven MHD modes are mitigated with ECH, and some modes are not.

Effect of rotational transform

- The energy confinement is degraded as the rotational transform increases, which contradicts the ISS04 scaling \((\nu/2\pi)^{0.41}\).