1. Purpose of Experiments
Include immediate goal of the experiments, scientific importance and/or programmatic relevance. Refer to any relevant program milestones.

Goal of this experiment is to orient LH wave directly toward SOL region using low N// launch and to make LH power absorbed in the SOL region. By measuring the response time and profile shape of divertor heat flux, ion saturation current, floating potential, we can calibrate the response time and heat flux profile shape previously observed in LH power modulation experiment. This is an attempt to distinguish how much power is absorbed directly in SOL and how much is still being absorbed near the last closed flux surface.

Background
Discuss Physics Basis of the proposed research. Prior results at Alcator or elsewhere, and any related work being carried out separately.

Previously, surface thermocouples are used to measure the modulation of parallel heat caused by LH power modulation [1]. The data revealed that power is deposited very closed to edge. At the same time, the core temperature modulation was not observed, it is inferred that the power is mostly absorbed in SOL plasmas. Modeling using 2D SOL plasma with GENRAY/CQL3D showed that the very dense cold plasma often observed in divertor region is sufficiently collisional to cause a significant loss of current drive.

However, the GENRAY/CQL3D model has one peculiar disagreement with experiment, which is heat flux profile on divertor. The experimental measurement in LH modulation experiment [1] shows that self-similarity between heat profile during OH and LH phase, indicating pure LH contribution (red in the left figure) profile shape is also similar to the other two curves. While this experimental observation suggests that LH power is coming from core region, the heat deposition profile evaluated from GENRAY/CQL3D (shown in the right figure) looks rather different. For this analysis, the local power deposition along rays are mapped to midplane and binned to generate a profile. It can be seen that the evaluated profile shape is much broader radially and peaked at center.
This agreement may be suggesting that although the model can reproduce the drop of HXR emission observed in the experiment, the mechanism of causing the absorption, which is the existence of cold dense plasma in the divertor region, is not the mechanism working in the experiment. In the experiment, the ion saturation

In this experiment, we propose to direct LH wave to lower X-point region using low N// launch. By having LH power purposely being absorbed by SOL plasma, we can measure the profile shape and response time of divertor heat flux. In this experiment, we propose to measure the response to modulation using MPL (mirror Langmuir probes) system, which has a higher time resolution (~1MHz).

2. Approach

Describe the methodology to be employed; explain the rationale for the choice of parameters, etc. Describe the analysis techniques to be employed in interpreting the data, if applicable. If the approach is standard or otherwise self-evident, this section may be absorbed into the Experimental Plan.

We use MPL system connected to J divertor probe. Use low N// to make sure that LH is NOT accessible and to have all LH power absorbed in divertor region.

3. Resources

4.1 Machine and Plasma Parameters

<table>
<thead>
<tr>
<th>Toroidal Field:</th>
<th>5.4T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Current:</td>
<td>0.7MA</td>
</tr>
<tr>
<td>Working Gas Species:</td>
<td>D2</td>
</tr>
<tr>
<td>Density:</td>
<td>0.94±0.13x10^{20} m^{-3}</td>
</tr>
</tbody>
</table>

Boronization Requested (if yes, specify whether overnight or between-shot, how recently needed, and any special conditions.):

Equilibrium configuration (if possible, refer to database equilibria): 1140822024

4.2 Auxiliary Systems

ICRF Power, No
LHCD Power, pulse length, phasing: N//=1.6 and 1.9 (or 2.3) Power modulation
Pellet Injection (species):
Impurity blow-off injection:
Diagnostic Neutral Beam:
Special gas puffing:
Cryopump: Yes (if available)
Non-axisymmetric Coils (Connections, Current);
Other:

4.3 Diagnostics
List required diagnostics, and any special setup or configuration, e.g. non-standard digitization rate.

Standard diagnostics set + J divertor probles connected with Mirror Langmuir Probe system.

4. Experimental Plan
Both sections must be filled in.

5.1 Run sequence Plan
Specify total number of runs required, and any special requirements, such as consecutive days, no Monday runs, extended run period – 10 hours maximum – etc.

This experiment requires a few good (only one if lucky) shot, but it needs a deciated set up for LH operation, divertor probe circuitl.

1) Load 1140822024 (LSN, 5.4T, 700 kA Reload 11)
   LH modulation shot (50msec low and high power (50/250 kW)
   from 0.6-1.4sec. Use n//=1.5 during the first half and 1.9 (or 2.3)
   during the second half.

2) If density is too low or too high, adjust it and repeat.

5. Anticipated Results
Discuss possible experimental outcomes and implications. Indicate if the program may be expected to lead to publications, milestone completions, improved operating techniques, etc. Indicate if the experiments are intended to contribute to a joint research effort, an ITER request, or an external database.

Previously, the response time of ion-saturation current to LH power modulation is about 1ms-2ms. If a significant fraction of power is directly absorbed in SOL, as modeled in GENRAY/CQL3D, the response must be much shorter than the observation. This experiment can be used to validate if absorption mechanism used in the code is the real mechanism or not.

6. References
Include references both to external and internal literature or communications which bear on this proposal. See Section 2.