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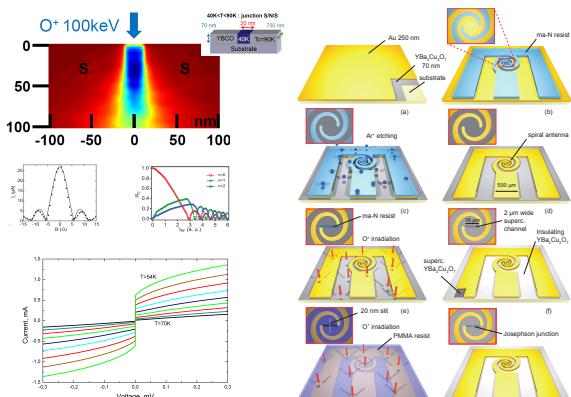
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Terahertz heterodyne detection based on ion-irradiated high-T_c Josephson junctions and arrays

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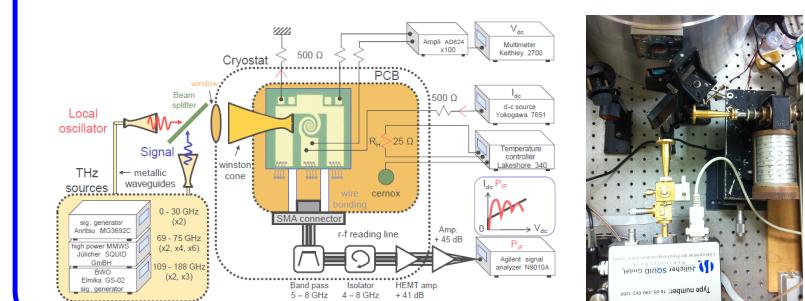
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Ion-irradiated junctions and manufacturing process



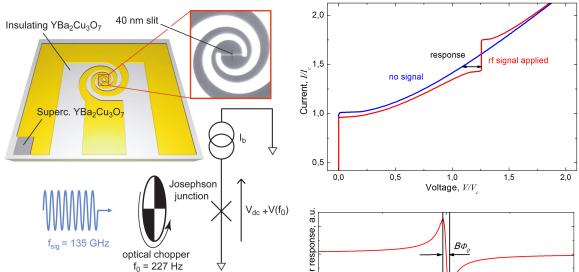
Good Josephson properties + variable R_N

Mixing experiment

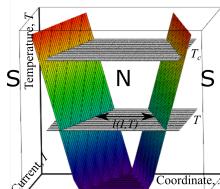


Generation linewidth

Detector response technique

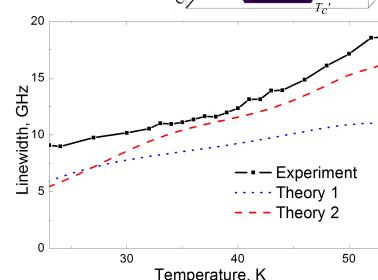
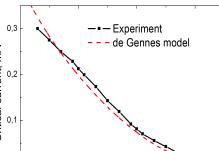
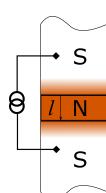


Linewidth
is determined by:
thermal noise
+
1/f-noise



Theory (thermal noise):

- variable normal part (Katz)
- nonlinear noise power transformation (Likharev-Semenov)
- proximity effect Ic(T) dependence (de Gennes)



Main conclusion:

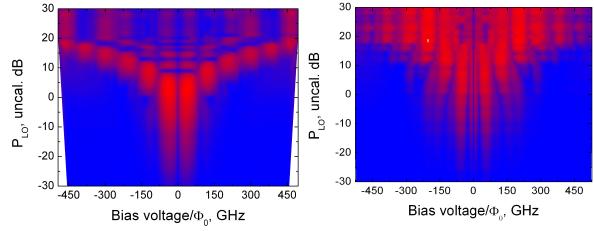
thermal noise is the main contribution to the linewidth

Conclusion

- Thermal noise gives the main contribution to the Josephson generation linewidth of ion-irradiated junctions
- Giant Shapiro steps (and therefore effective mixing) are achievable in the hundred-GHz band when temperature is high and spread of parameters is lower.
- Closely spaced slits form a single junction with low T_j.

4JJ array mixing properties

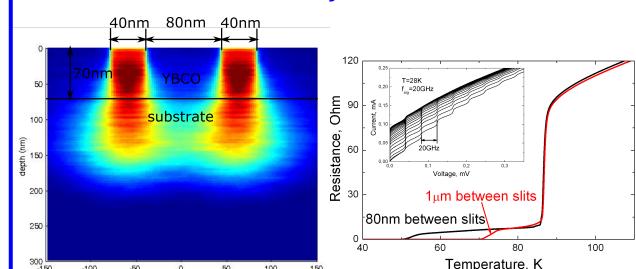
$$F_{LO}=20\text{GHz}, F_{sign}=14\text{GHz}, T=66\text{K}$$



$$F_{LO}=147\text{GHz}, F_{sign}=141\text{GHz}, T=66\text{K}$$

Main conclusion:
if T is close to T_j parameters spread is less
→ giant Shapiro steps

"Multislit" junctions



Main conclusion: all samples with closely spaced slits worked as one junction