# Observing Transients In Their Infancy

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# Goals

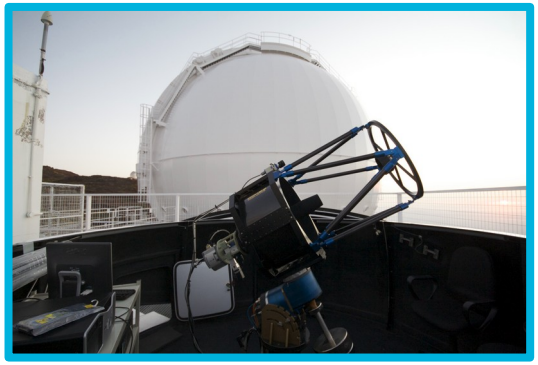
- **Rapid follow up of transients**
  - Model for classification/vetting
  - Automated triggering
- Particular focus on **fast transients**

# Fast Rising Transients

- Rise time scales < 10 days
- Notable type, Fast Blue Optical Transients:
  - Rise time < 5 days, blue, luminosities -15 > Mag > -20
  - Unknown mechanism, not explained by 56Ni decay
    - Shock wave, CSM interaction
    - Central engine: Spin powered magnetar or accreting compact object
  - Well sampled early light curve needed to probe different models


# GOTO: Gravitational-Wave Optical Transient Observer

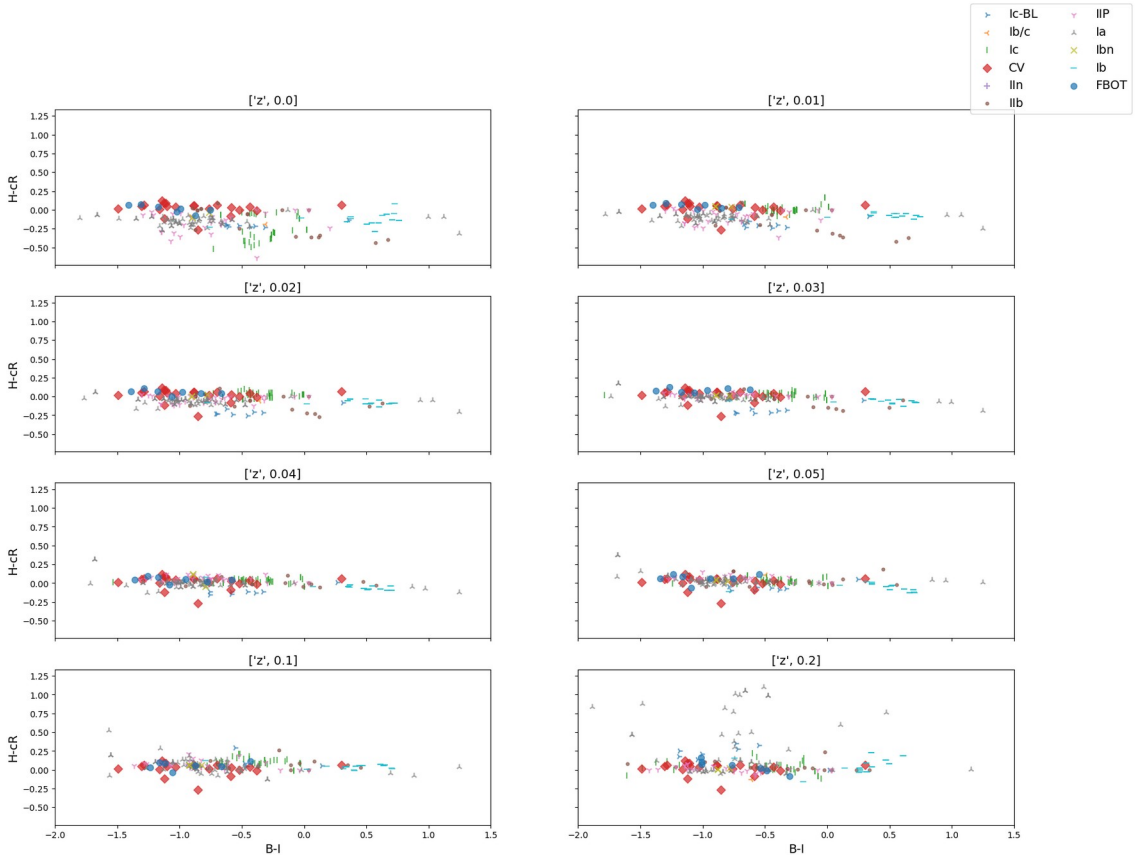
- Follow up for gravitational-wave detections from LIGO and VIRGO
- 32 telescopes across two sites
- Each mount FoV 40 square degrees
- Full sky coverage every 3 days



# Telescopes on La Palma, Roque de los Muchachos Observatory

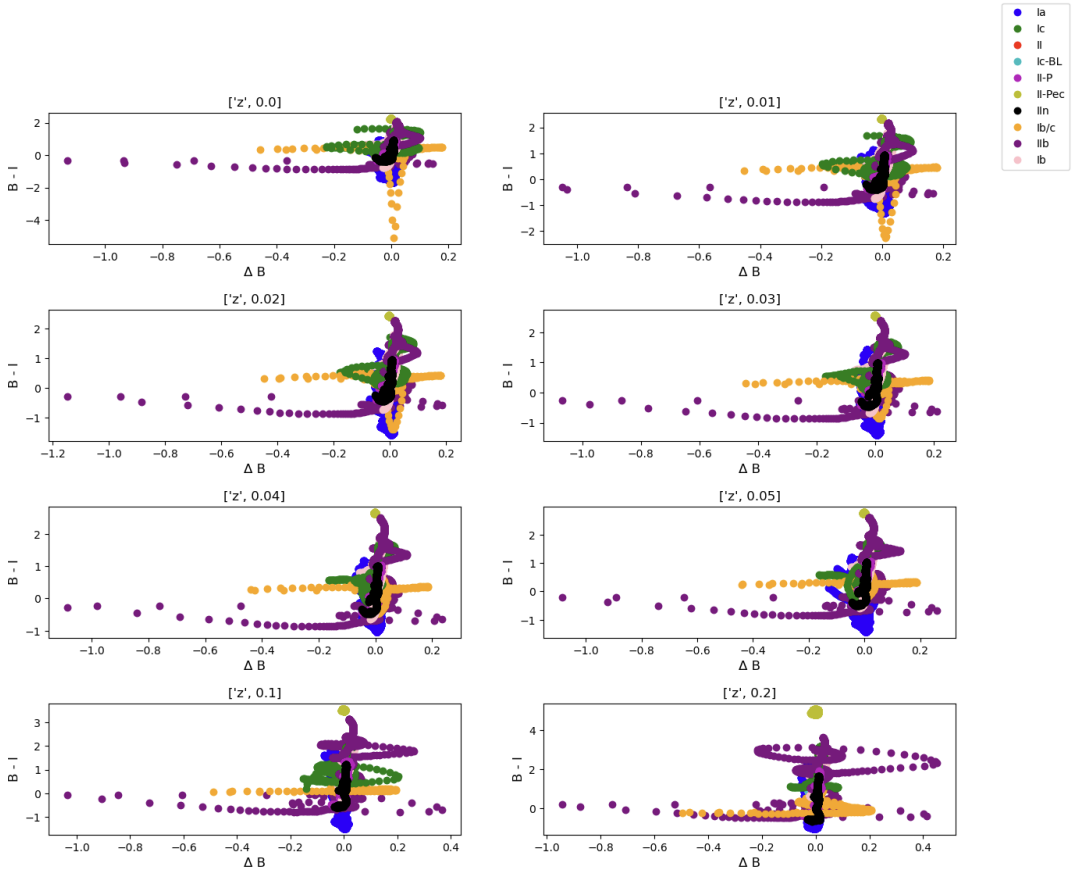
- pt5m:
  - 0.5m
  - Robotic
  - Filters: B, V, R, I, Hα
- Liverpool Telescope (LT):
  - 2m
  - Robotic
  - SPRAT

# Using Hα



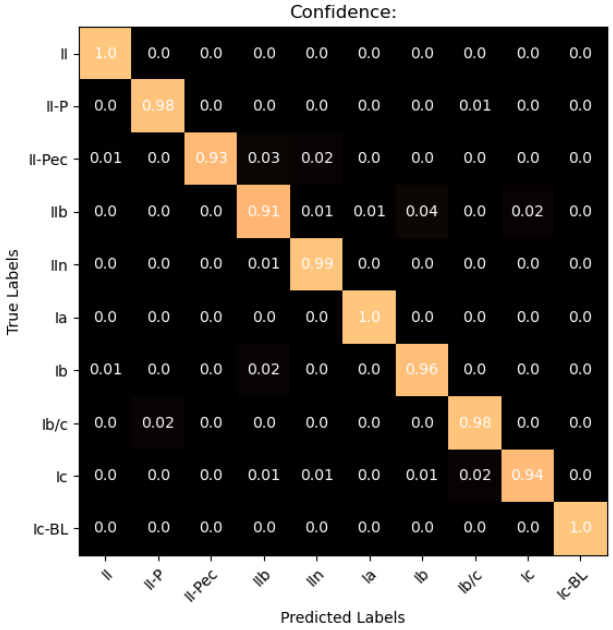

- Investigated using spectroscopic observations of individual objects
- Features moved out of filter with increasing Redshift
- No clear separation of types in either colour of Hα excess

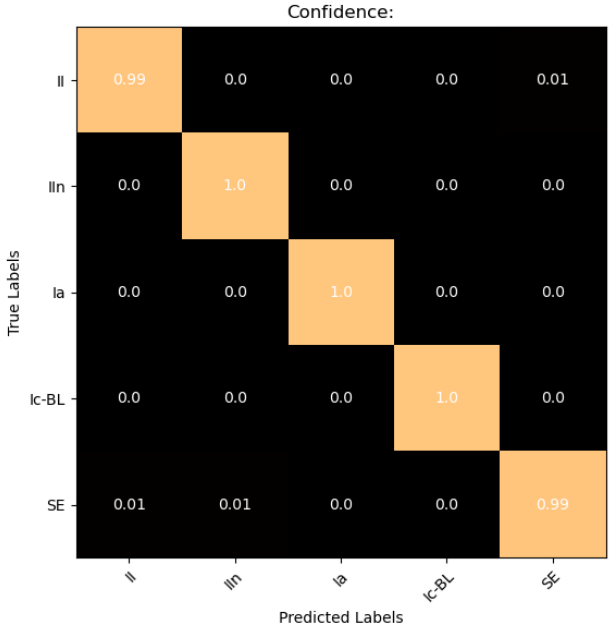
# Time Separated Imaging




- Investigated using model light curves produced for sources
  - More limited objects
- Change in values with Redshift but features remain present
- Fast rising objects, IIb, Ib, Ic, most clearly distinguishable

# Machine Learning




- Difficultly in viewing all possible features = ML potential solution
- Using time separated imaging due to greater number of data points
- Initial model suggests low priority objects can be vetted out
- With further grouping model successfully identified types
- Currently incomplete model selection

## Future Work

- Run ML with complete range of models
- Test observation strategy on pt5m
- Setup infrastructure to tie GOTO detections, autonomous triggering of pt5m and the LT, and ML models together

## Conclusion

- GOTO will provide a steady stream of detected transients < 3 days after explosion
- Robotic infrastructure is present on La Palma
- Promising potential in using small (0.5m) telescopes for vetting transients