Ocelot
Relational Logic in a Solver-Aided Language

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http://ocelot.tools
Ocelot is a **DSL for relational logic**, embedded in the Rosette solver-aided language.

The definition:

```
(define X (join d (~ contents)))
(println X)
> (join d (~ contents))
```

Supports **synthesis** of relational expressions, and combination with other constraints.

All $d: \text{Dir} \mid \text{lone} \; d.\neg\text{contents}$ becomes:

```
(all ([d \text{Dir}])
  (lone (join d (~ contents))))
```

Analysis backend is SMT (Z3)
Ocelot can synthesize and debug large memory model specifications

[Bornholt & Torlak, PLDI 2017]

**Synthesis**

- **PowerPC**
  - 768 tests [Alglave et al, CAV’10]
  - ✓ 12 seconds
  - Search space: $2^{1406}$
  - Not equivalent to published model!

- **x86**
  - 10 tests
  - ✓ 2 seconds
  - Search space: $2^{624}$
  - Not equivalent to TSO!

**Ambiguity**

- 9 new tests sync, lwsync, etc.
- 4 new tests mfence, xchg
Ocelot is **fast** at both verification and higher-order queries.

- **Verification**
  - As fast as a custom memory model decision procedure.

- **Equivalence**
  - Average 22× faster than Alloy*.
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