

R-Theory: Schema

```
{
  "$id": "https://example.org/rtheory/canonical.schema.json",
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "title": "R-Theory Canonical Compendium Schema",
  "type": "object",
  "additionalProperties": false,
  "required": [
    "meta",
    "canonical",
    "primitive_index",
    "lineage",
    "governance",
    "canonical_math",
    "machine_interface",
    "status",
    "sorts",
    "primitive_symbols",
    "formal_axioms",
    "admissibility",
    "catalog_unmodeled_requirements",
    "notes",
    "projections"
  ],
  "properties": {
    "meta": {
      "type": "object",
      "additionalProperties": false,
      "required": [
        "title",
        "subtitle",
        "edition",
        "author",
        "compiled_by",
        "language",
        "license",
        "date_compiled",
        "canonical_hash",
        "build_environment"
      ],
      "properties": {
        "title": { "type": "string", "minLength": 1 },
        "subtitle": { "type": "string", "minLength": 1 },
        "edition": { "type": "string", "minLength": 1 },
        "author": { "type": "string", "minLength": 1 },
        "compiled_by": { "type": "string", "minLength": 1 },
        "language": { "type": "string", "minLength": 1 },
        "license": { "type": "string", "minLength": 1 },
        "date_compiled": { "type": "string", "minLength": 1 },
        "canonical_hash": { "type": "string", "minLength": 1 },
        "build_environment": { "type": "string", "minLength": 1 }
      }
    }
  }
}
```

```
"compiled_by": { "type": "string", "minLength": 1 },
"language": { "type": "string", "minLength": 1 },
"license": { "type": "string", "minLength": 1 },
"date_compiled": { "type": "string", "format": "date-time" },
"canonical_hash": {
  "type": "object",
  "additionalProperties": false,
  "required": ["algorithm", "value"],
  "properties": {
    "algorithm": { "type": "string", "enum": ["SHA3-512"] },
    "value": { "type": "string", "pattern": "^[0-9a-fA-F]{128}$" }
  }
},
"build_environment": { "type": "string", "minLength": 1 }
},
"canonical": {
  "type": "object",
  "additionalProperties": false,
  "required": ["slots"],
  "properties": {
    "slots": {
      "type": "object",
      "additionalProperties": false,
      "required": [
        "structural_layer",
        "relational_layer",
        "projection_layer",
        "calibration_layer",
        "governance_appendices"
      ],
      "properties": {
        "structural_layer": { "$ref": "#/$defs/slotList" },
        "relational_layer": { "$ref": "#/$defs/slotList" },
        "projection_layer": { "$ref": "#/$defs/slotList" },
        "calibration_layer": { "$ref": "#/$defs/slotList" },
        "governance_appendices": { "$ref": "#/$defs/slotList" }
      }
    }
  }
},
"primitive_index": {
```

```
"type": "object",
"additionalProperties": false,
"propertyNames": { "$ref": "#/$defs/slotKey" },
"patternProperties": {
  "^A-W$": { "type": "string", "minLength": 1 }
},
},
"lineage": { "type": "string", "minLength": 1 },

"governance": {
  "type": "object",
  "additionalProperties": false,
  "required": [
    "admissibility_ruleset",
    "closure_ceiling",
    "projection_freedom",
    "ontology_allowed",
    "residual_reporting_required",
    "calibration_anchors",
    "ethical_guidelines"
  ],
  "properties": {
    "admissibility_ruleset": {
      "type": "object",
      "additionalProperties": false,
      "required": ["name", "elements"],
      "properties": {
        "name": { "type": "string", "enum": ["fivefold_predicate"] },
        "elements": {
          "type": "array",
          "minItems": 5,
          "maxItems": 5,
          "uniqueItems": true,
          "items": {
            "type": "string",
            "enum": [
              "boundedness",
              "no_new_primitives",
              "mirror_accessibility",
              "residual_reporting",
              "projection_declaration"
            ]
          }
        }
      }
    }
  }
}
```

```
        },
        "closure_ceiling": { "type": "string", "enum": ["L3"] },
        "projection_freedom": { "type": "boolean" },
        "ontology_allowed": { "type": "boolean", "const": false },
        "residual_reporting_required": { "type": "boolean" },
        "calibration_anchors": {
            "type": "array",
            "minItems": 1,
            "uniqueItems": true,
            "items": { "type": "string", "minLength": 1 }
        },
        "ethical_guidelines": {
            "type": "array",
            "minItems": 1,
            "items": { "type": "string", "minLength": 1 }
        }
    },
    "canonical_math": {
        "type": "object",
        "additionalProperties": false,
        "required": ["domain", "operators", "composites", "identities", "phase_wheel", "samples"],
        "properties": {
            "angle_convention": {
                "type": "object",
                "additionalProperties": false,
                "required": ["preferred_unit", "interchangeability_disclaimer"],
                "properties": {
                    "preferred_unit": { "type": "string", "enum": ["degrees", "radians"] },
                    "interchangeability_disclaimer": { "type": "string", "minLength": 1 }
                }
            },
            "domain": {
                "type": "object",
                "additionalProperties": false,
                "required": ["x_symbol", "x_units", "x_range", "singular_sets"],
                "properties": {
                    "x_symbol": { "type": "string", "minLength": 1 },
                    "x_units": { "type": "string", "enum": ["degrees", "radians"] },
                    "x_range": {
                        "type": "array",
                        "minItems": 1
                    }
                }
            }
        }
    }
}
```

```

    "type": "object",
    "additionalProperties": false,
    "required": ["type", "start", "end"],
    "properties": {
        "type": { "type": "string", "enum": ["half_open_interval"] },
        "start": { "type": ["number", "string"] },
        "end": { "type": ["number", "string"] }
    }
},
"singular_sets": {
    "type": "array",
    "minItems": 1,
    "items": { "type": "string", "minLength": 1 }
}
},
},
"operators": {
    "type": "object",
    "additionalProperties": false,
    "required": ["srx", "sxp", "cxp", "crx"],
    "properties": {
        "srx": { "$ref": "#/$defs/namedExpr" },
        "sxp": { "$ref": "#/$defs/namedExpr" },
        "cxp": { "$ref": "#/$defs/namedExpr" },
        "crx": { "$ref": "#/$defs/namedExpr" }
    }
},
"composites": {
    "type": "object",
    "additionalProperties": false,
    "required": ["urx", "uxp", "sawdown", "sawup", "flatwave"],
    "properties": {
        "urx": { "$ref": "#/$defs/namedExpr" },
        "uxp": { "$ref": "#/$defs/namedExpr" },
        "sawdown": { "$ref": "#/$defs/namedExpr" },
        "sawup": { "$ref": "#/$defs/namedExpr" },
        "flatwave": { "$ref": "#/$defs/namedExpr" }
    }
},
"identities": {
    "type": "array",

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```
"minItems": 1,
"items": {
  "type": "object",
  "additionalProperties": false,
  "required": ["id", "lhs", "rhs", "notes"],
  "properties": {
    "id": { "type": "string", "minLength": 1 },
    "lhs": { "$ref": "#/$defs/namedExpr" },
    "rhs": { "$ref": "#/$defs/namedExpr" },
    "notes": { "type": "string", "minLength": 1 }
  }
},
},
};

"phase_wheel": {
  "type": "object",
  "additionalProperties": false,
  "required": ["encoding", "octants"],
  "properties": {
    "encoding": {
      "type": "object",
      "additionalProperties": false,
      "required": [
        "decay_symbol",
        "growth_symbol",
        "manifest_symbol",
        "mirror_symbol",
        "phase_symbol",
        "cophase_symbol"
      ],
      "properties": {
        "decay_symbol": { "type": "string", "minLength": 1 },
        "growth_symbol": { "type": "string", "minLength": 1 },
        "manifest_symbol": { "type": "string", "minLength": 1 },
        "mirror_symbol": { "type": "string", "minLength": 1 },
        "phase_symbol": { "type": "string", "minLength": 1 },
        "cophase_symbol": { "type": "string", "minLength": 1 }
      }
    },
    "octants": {
      "type": "array",
      "minItems": 8,
      "maxItems": 8,
      "items": {

```



```
"deg": { "type": "number" },
"srx": { "type": ["number", "null"] },
"sxp": { "type": ["number", "null"] },
"cxp": { "type": ["number", "null"] },
"crx": { "type": ["number", "null"] },
"uxp": { "type": ["number", "null"] },
"urx": { "type": ["number", "null"] },
"sawdown": { "type": ["number", "null"] },
"sawup": { "type": ["number", "null"] },
"flatwave": { "type": ["number", "null"] }
}
}
}
},
},
}

"machine_interface": {
"type": "object",
"additionalProperties": false,
"required": [
"serialization_format",
"logical_schema",
"query_endpoint",
"compatibility",
"dependency_keys"
],
"properties": {
"serialization_format": {
"type": "array",
"minItems": 1,
"uniqueItems": true,
"items": { "type": "string", "enum": ["yaml", "json", "ttl"] }
},
"logical_schema": { "type": "string", "minLength": 1 },
"query_endpoint": { "type": "string", "pattern": "^/" },
"compatibility": {
"type": "array",
"minItems": 1,
"uniqueItems": true,
"items": { "type": "string", "minLength": 1 }
},
"dependency_keys": {
"type": "array",
"minItems": 1,
```

```
        "uniqueItems": true,
        "items": { "type": "string", "minLength": 1 }
    }
}
},
{
    "status": {
        "type": "object",
        "additionalProperties": false,
        "required": ["admissibility_summary", "verification"],
        "properties": {
            "admissibility_summary": {
                "type": "object",
                "additionalProperties": false,
                "required": [
                    "structure_status",
                    "projection_status",
                    "calibration_status",
                    "practice_status",
                    "ethical_status"
                ],
                "properties": {
                    "structure_status": { "type": "string", "enum": ["closed"] },
                    "projection_status": { "type": "string", "enum": ["free"] },
                    "calibration_status": { "type": "string", "enum": ["continuous"] },
                    "practice_status": { "type": "string", "enum": ["governed"] },
                    "ethical_status": { "type": "string", "enum": ["transparent"] }
                }
            },
            "verification": {
                "type": "object",
                "additionalProperties": false,
                "required": [
                    "validation_suite",
                    "unit_tests_passed",
                    "residual_variance",
                    "anomalies",
                    "meta_admissibility"
                ],
                "properties": {
                    "validation_suite": { "type": "string", "minLength": 1 },
                    "unit_tests_passed": { "type": "integer", "minimum": 0 },
                    "residual_variance": { "type": "number", "minimum": 0 },
                    "anomalies": { "type": "integer", "minimum": 0 },
                    "meta_admissibility": { "type": "string", "minLength": 1 }
                }
            }
        }
    }
}
```

```
        "meta_admissibility": { "type": "boolean" }
    }
}
},
},
"sorts": {
    "type": "array",
    "minItems": 1,
    "items": {
        "type": "object",
        "additionalProperties": false,
        "required": ["id", "description"],
        "properties": {
            "id": { "type": "string", "minLength": 1 },
            "description": { "type": "string", "minLength": 1 }
        }
    }
},
"primitive_symbols": {
    "type": "array",
    "minItems": 1,
    "items": {
        "type": "object",
        "additionalProperties": false,
        "required": ["id", "sort", "kind"],
        "properties": {
            "id": { "type": "string", "minLength": 1 },
            "sort": { "type": "string", "minLength": 1 },
            "kind": { "type": "string", "minLength": 1 },
            "paper": { "type": "string", "minLength": 1 },
            "notes": { "type": "string", "minLength": 1 }
        }
    }
},
"formal_axioms": {
    "type": "array",
    "minItems": 1,
    "items": {
        "type": "object",
        "additionalProperties": false,
        "required": ["id", "layer", "name", "formal", "enforcement", "depends_on"]
    }
}
```



```
"type": "object",
"additionalProperties": false,
"required": ["id", "type", "text"],
"properties": {
    "id": { "type": "string", "minLength": 1 },
    "type": { "type": "string", "minLength": 1 },
    "text": { "type": "string", "minLength": 1 }
},
},
},
},


"notes": {
    "type": "object",
    "additionalProperties": false,
    "required": ["intent", "interoperability", "revision_policy", "canonical_close"],
    "properties": {
        "intent": { "type": "string", "minLength": 1 },
        "interoperability": { "type": "string", "minLength": 1 },
        "revision_policy": { "type": "string", "minLength": 1 },
        "canonical_close": { "type": "string", "minLength": 1 }
    }
},
},


"projections": {
    "type": "array",
    "minItems": 1,
    "items": { "$ref": "#/$defs/projection" }
}
},
},


"$defs": {
    "slotKey": {
        "type": "string",
        "pattern": "^[A-W]$"
    },
    "slotList": {
        "type": "array",
        "minItems": 1,
        "uniqueItems": true,
        "items": { "$ref": "#/$defs/slotKey" }
    },
},


"exprNode": {
    "oneOf": [
```

```
{ "type": "string", "minLength": 1 },
{ "type": "number" },
{
  "type": "object",
  "additionalProperties": false,
  "required": ["fn", "args"],
  "properties": {
    "fn": { "type": "string", "minLength": 1 },
    "args": {
      "type": "array",
      "minItems": 1,
      "items": { "$ref": "#/$defs/exprNode" }
    }
  }
},
{
  "type": "object",
  "additionalProperties": false,
  "required": ["op", "lhs", "rhs"],
  "properties": {
    "op": { "type": "string", "minLength": 1 },
    "lhs": { "$ref": "#/$defs/exprNode" },
    "rhs": { "$ref": "#/$defs/exprNode" }
  }
}
],
},
{
  "name": "namedExpr": {
    "type": "object",
    "additionalProperties": false,
    "required": ["name", "expr", "display"],
    "properties": {
      "name": { "type": "string", "minLength": 1 },
      "expr": { "$ref": "#/$defs/exprNode" },
      "display": { "type": "string", "minLength": 1 }
    }
  },
  "algorithmStep": {
    "oneOf": [
      {
        "type": "object",
        "additionalProperties": false,
```

```

"required": ["set", "call", "args"],
"properties": {
    "set": { "type": "string", "minLength": 1 },
    "call": { "type": "string", "minLength": 1 },
    "args": { "type": "array" }
},
{
    "type": "object",
    "additionalProperties": false,
    "required": ["set", "expr"],
    "properties": {
        "set": { "type": "string", "minLength": 1 },
        "expr": { "type": "string", "minLength": 1 }
    }
},
{
    "type": "object",
    "additionalProperties": false,
    "required": ["if", "then"],
    "properties": {
        "if": {
            "type": "object",
            "additionalProperties": false,
            "required": ["op", "lhs", "rhs"],
            "properties": {
                "op": { "type": "string", "enum": [">", ">=", "<", "<=", "==" , "!="] },
                "lhs": { "type": "string", "minLength": 1 },
                "rhs": { "type": ["string", "number"] }
            }
        },
        "then": {
            "type": "array",
            "minItems": 1,
            "items": { "$ref": "#/$defs/algorithmThenStep" }
        }
    }
},
{
    "type": "object",
    "additionalProperties": false,
    "required": ["return"],
    "properties": {
        "return": {

```

```
        "type": "array",
        "minItems": 1,
        "items": { "type": "string", "minLength": 1 }
    }
}
]
},
{
"algorithmThenStep": {
"oneOf": [
{
"type": "object",
"additionalProperties": false,
"required": ["set", "call", "args"],
"properties": {
"set": { "type": "string", "minLength": 1 },
"call": { "type": "string", "minLength": 1 },
"args": { "type": "array" }
}
},
{
"type": "object",
"additionalProperties": false,
"required": ["set", "expr"],
"properties": {
"set": { "type": "string", "minLength": 1 },
"expr": { "type": "string", "minLength": 1 }
}
},
{
"type": "object",
"additionalProperties": false,
"required": ["return"],
"properties": {
"return": {
"type": "array",
"minItems": 1,
"items": { "type": "string", "minLength": 1 }
}
}
}
]
},
{
}];
```

```
"projection": {
  "type": "object",
  "additionalProperties": false,
  "required": [
    "id",
    "title",
    "version",
    "language",
    "axiom_refs",
    "canonical_slots_used",
    "declared_primitives",
    "domain",
    "principles",
    "definitions",
    "admissibility_contract",
    "algorithm"
  ],
  "properties": {
    "id": { "type": "string", "minLength": 1 },
    "title": { "type": "string", "minLength": 1 },
    "version": { "type": "string", "minLength": 1 },
    "language": { "type": "string", "minLength": 1 },
    "axiom_refs": {
      "type": "array",
      "minItems": 1,
      "items": { "type": "string", "minLength": 1 }
    },
    "canonical_slots_used": { "$ref": "#/$defs/slotList" },
    "declared_primitives": { "$ref": "#/$defs/slotList" },
    "domain": {
      "type": "object",
      "additionalProperties": false,
      "required": ["phase_symbol", "phase_range", "dimensionless", "inputs"],
      "properties": {
        "phase_symbol": { "type": "string", "minLength": 1 },
        "phase_range": {
          "type": "object",
          "additionalProperties": false,
          "required": ["type", "start", "end"],
          "properties": {
            "type": "string"
          }
        }
      }
    }
  }
}
```

```
"type": { "type": "string", "enum": ["half_open_interval"] },
  "start": { "type": ["string", "number"] },
  "end": { "type": ["string", "number"] }
},
"dimensionless": { "type": "boolean" },
"inputs": {
  "type": "object",
  "additionalProperties": false,
  "required": ["S_in", "C_out"],
  "properties": {
    "S_in": { "type": "string", "minLength": 1 },
    "C_out": { "type": "string", "minLength": 1 }
  }
},
},
},
},
},
"principles": {
  "type": "object",
  "additionalProperties": false,
  "required": [
    "no_preferred_frame",
    "no_preferred_user",
    "ontology_allowed",
    "projection_status",
    "structure_status",
    "practice_status",
    "residual_reporting_required"
  ],
  "properties": {
    "no_preferred_frame": { "type": "boolean" },
    "no_preferred_user": { "type": "boolean" },
    "ontology_allowed": { "type": "boolean" },
    "projection_status": { "type": "string", "minLength": 1 },
    "structure_status": { "type": "string", "minLength": 1 },
    "practice_status": { "type": "string", "minLength": 1 },
    "residual_reporting_required": { "type": "boolean" }
  }
},
"canon_math_ref": { "type": "string" },
"definitions": {
```

```
"type": "object",
"additionalProperties": true
},

"admissibility_contract": {
  "type": "object",
  "additionalProperties": false,
  "required": ["fivefold_predicate", "requirements"],
  "properties": {
    "fivefold_predicate": {
      "type": "array",
      "minItems": 5,
      "maxItems": 5,
      "uniqueItems": true,
      "items": {
        "type": "string",
        "enum": [
          "boundedness",
          "no_new_primitives",
          "mirror_accessibility",
          "residual_reporting",
          "projection_declaration"
        ]
      }
    },
    "requirements": {
      "type": "array",
      "minItems": 1,
      "items": { "type": "string", "minLength": 1 }
    }
  }
},

"algorithm": {
  "type": "object",
  "additionalProperties": false,
  "required": ["inputs", "steps", "invariances"],
  "properties": {
    "inputs": {
      "type": "array",
      "minItems": 1,
      "items": { "type": "string", "minLength": 1 }
    },
    "steps": {
```

```
        "type": "array",
        "minItems": 1,
        "items": { "$ref": "#/$defs/algorithmStep" }
    },
    "invariances": {
        "type": "array",
        "minItems": 1,
        "items": { "type": "string", "minLength": 1 }
    }
},
{
    "outputs": { "type": "object" },
    "safety_notes": { "type": "object" }
}
}
}
```