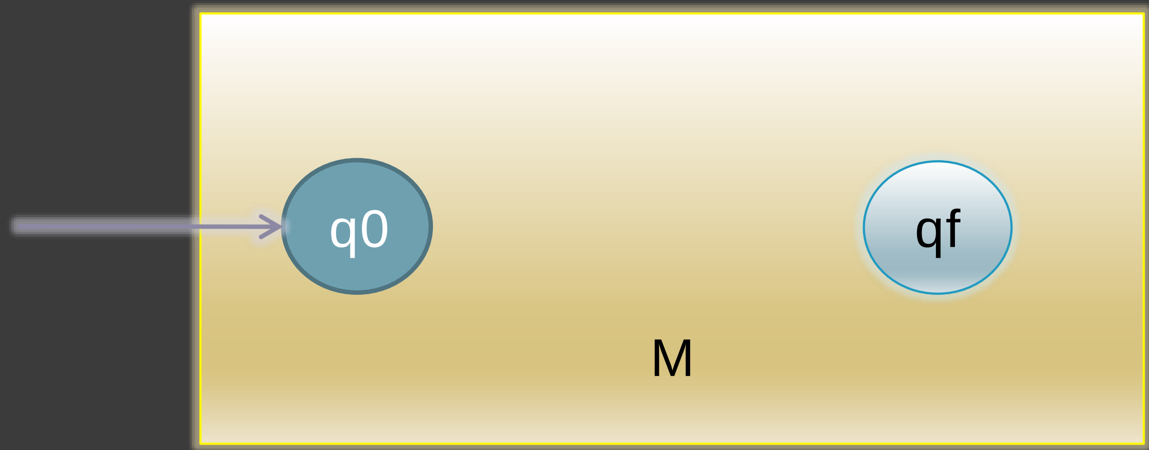
Equivalence of RE and FSA

- FSA accepts Regular Language
- RE represents Regular Language
- RE≡FSA
- How?
- 1. Conversion of RE to FSA (ε-NFA)
- 2. Conversion of FSA (DFA) to RE using Arden's theorem

Conversion of RE to FSA (ε-NFA)

Regular Expression
1. Φ
L(Φ)={ }

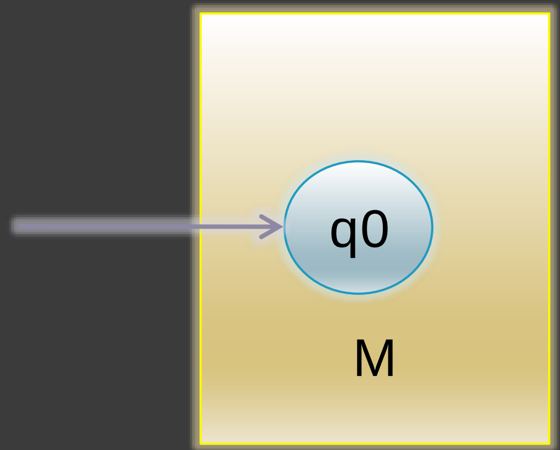
ε-NFA
M has no transition from initial state q0 to final state qf. So it can not accept any string. So language of M is Φ.
M accepts no string, L(M)={ }



Conversion of RE to FSA (ε-NFA)

Regular Expression
2. ε
L(ε)={ε}

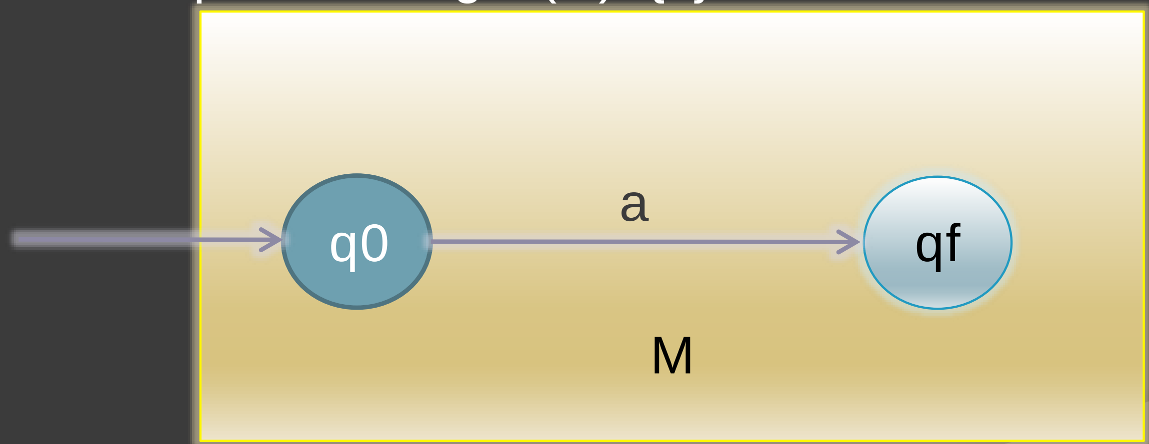
ε-NFA
M has single state which is both initial state and final state q0 .
So it can accept empty string. So language of M is {ε}.
M accepts empty string, L(M)={ε}



Conversion of RE to FSA (ε-NFA)

Regular Expression
3. a
L(a)={a}

ε-NFA
M has a single transition from initial state q0 to final state qf on input symbol a.
So it can not accept only one string a. So language of M is {a}.
M accepts no string, L(M)={a}



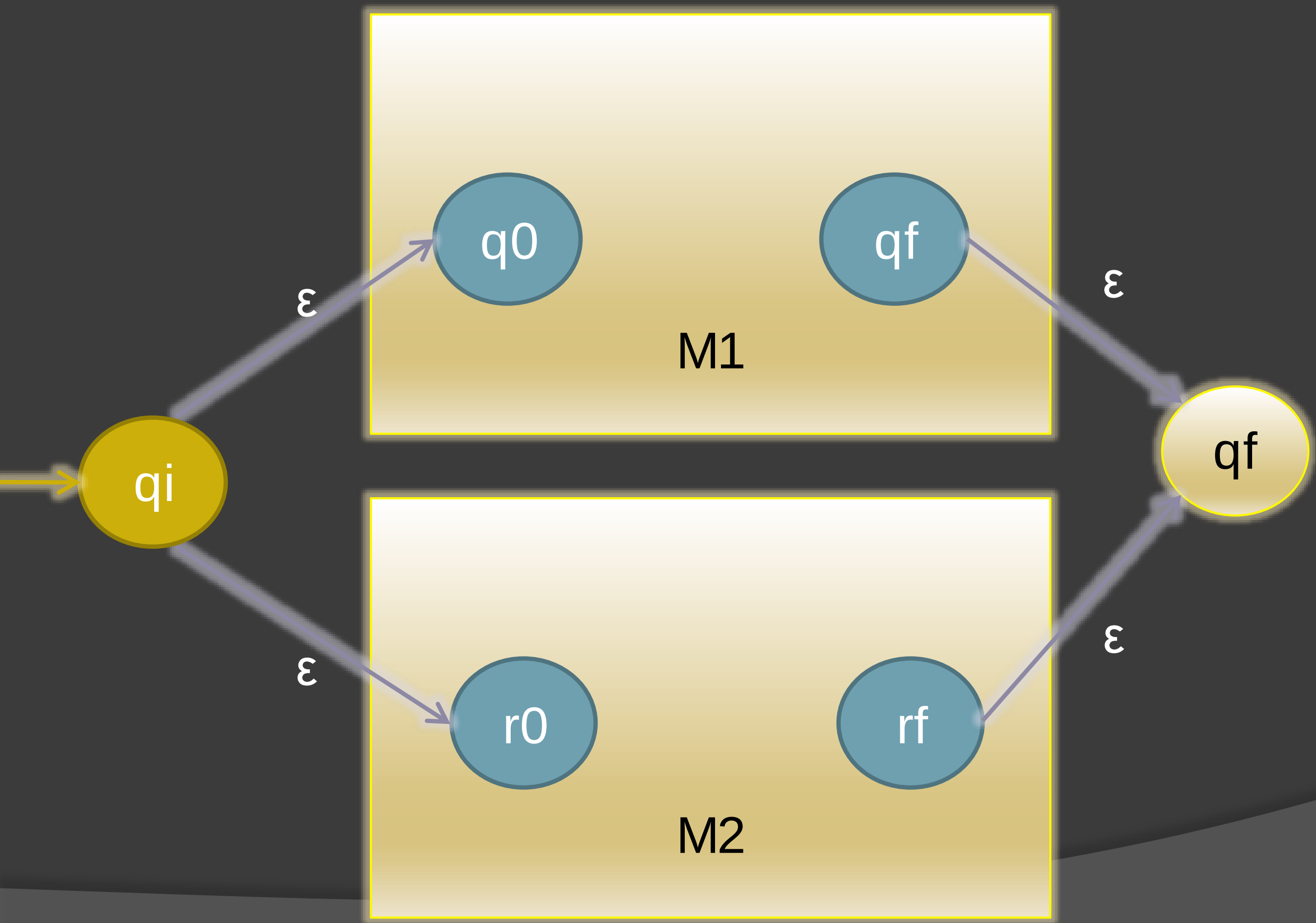
Conversion of RE to FSA (ε-NFA)

Regular Expression
3. r1+r2
L(r1+r2)=L(r1)UL(r2)

Suppose RE r1 and r2 is represented by NFA M1 and M2 respectively as follows

Conversion of RE to FSA (ε-NFA)

Construction of NFA for r1+r2



<u>ε-NFA M Idea</u>

1. Make initial states q0,r0 of M1 and M2 non initial in M

2. Make final states qf,rf of M1 and M2 non final in M

3.Introduce a new initial state qi

4.Introduce a new final state qf

5. Add ε-transitions from new initial state qi to old initial states q0,r0 of M1 and M2

6. Add ε-transitions from old final states qf,rf of M1 and M2 to new final state qf.

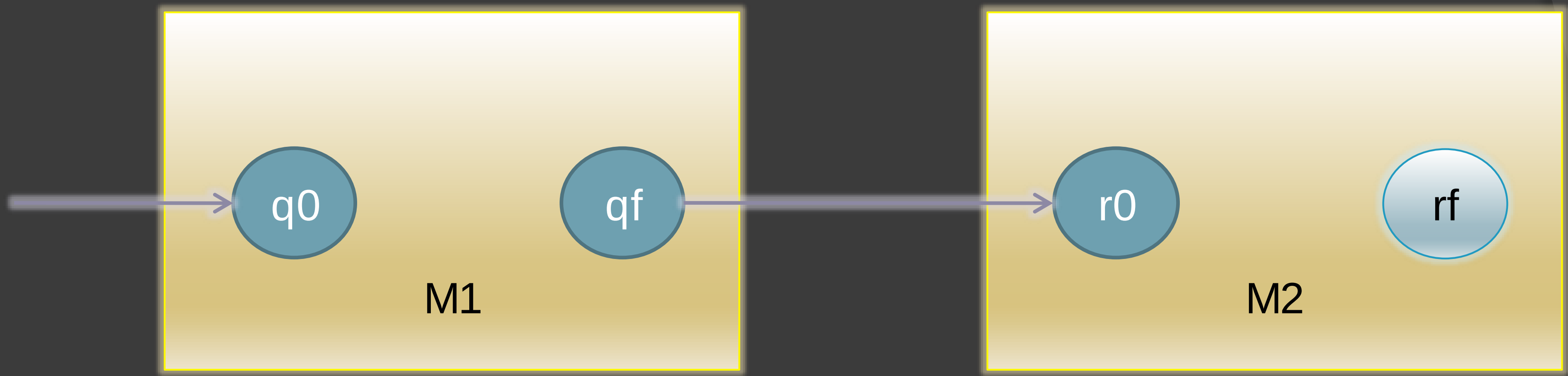
Conversion of RE to FSA (ε-NFA)

Regular Expression
5. r1r2
L(r1r2)=L(r1)L(r2)

Suppose RE r1 and r2 is represented by NFA M1 and M2 respectively as follows

Conversion of RE to FSA (ε-NFA)

Construction of ε-NFA for r1r2



<u>ε-NFA M Idea</u>

1. Make final state qf of M1 non final in M and initial state r0 of M2 non initial in M

2. Add ε-transitions from final state qf of M1 to initial state r0 of M2

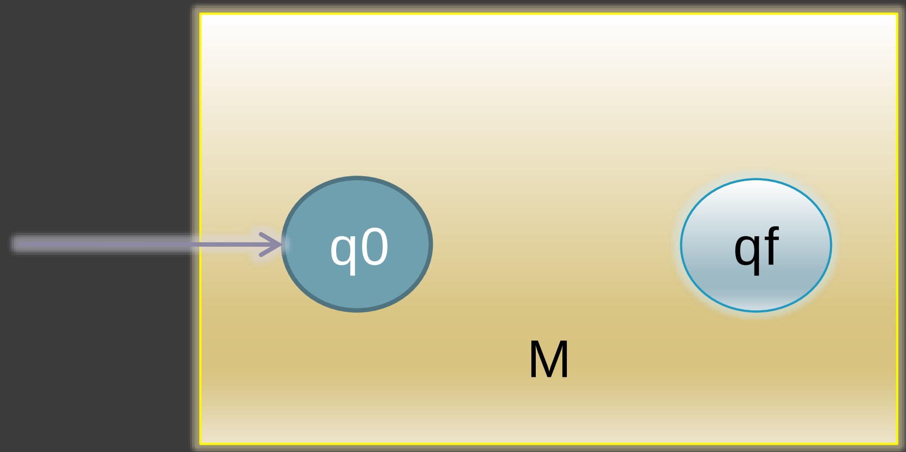
Conversion of RE to FSA (ε-NFA)

Regular Expression

6. r*

$L(r^*)=L(r)^*=L^0 \cup L^1 \cup L^2 \cup L^3 \ldots\ldots$

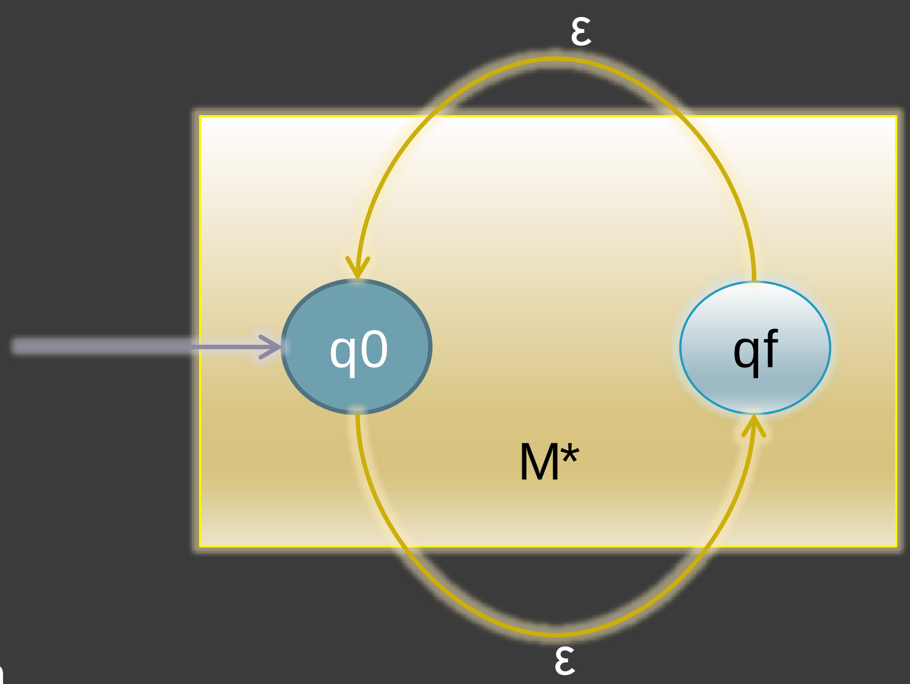
Suppose RE r is represented by NFA M as follows



Conversion of RE to FSA (ε-NFA)

Regular Expression
6. r*
$L(r^*)=L(r)^*=L^0 \cup L^1 \cup L^2 \cup L^3 \ldots\ldots$

Suppose RE r is represented by NFA M as follows

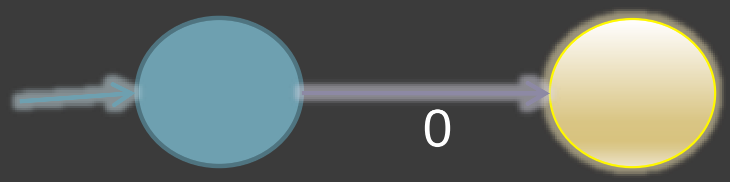


<u>**ε-NFA M* Idea**</u>

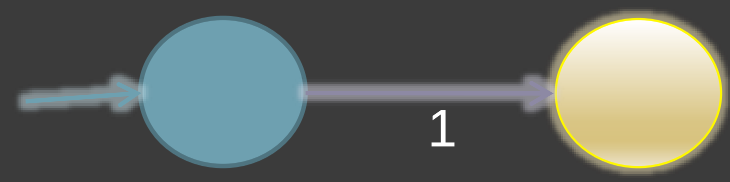
1. **Add ε-transition from final state qf of M to initial state q0 of M**
2. **Add ε-transition from initial state q0of M to final state qf of M**

Construct ε-NFA for RE (0+01)*

NFA for RE 0



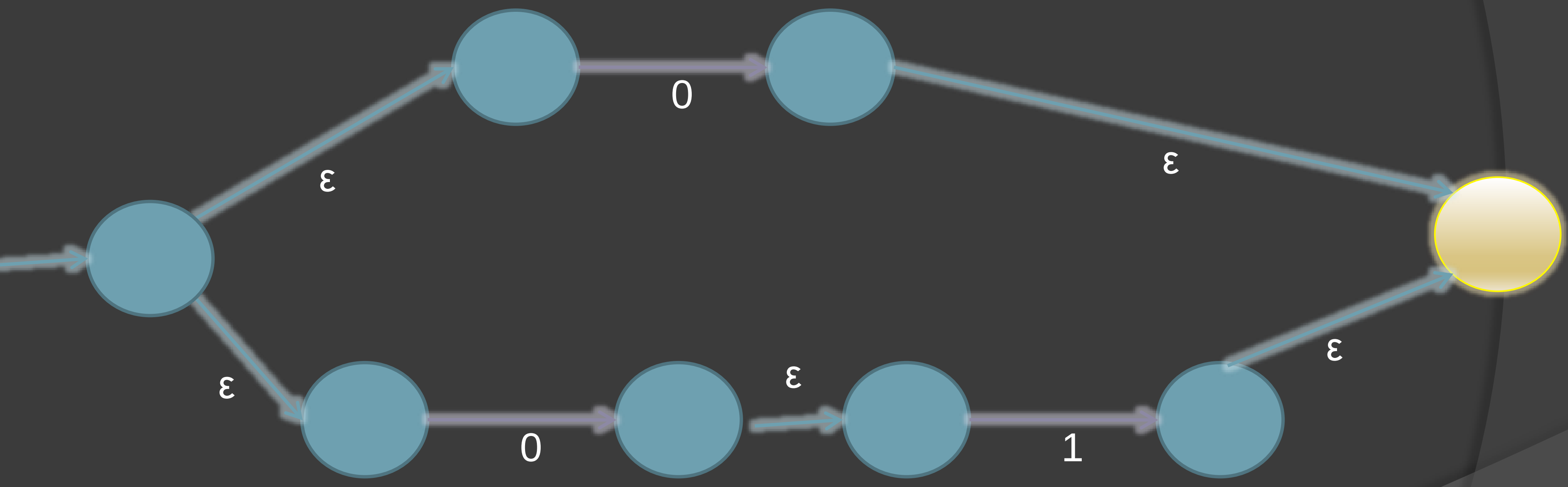
NFA for RE 1



NFA for RE 01

Construct ε-NFA for RE (0+01)*

NFA for RE 0+01



Construct ε-NFA for RE (0+01)*

NFA for RE (0+01)*